

SYNCHROMODAL CLASSES: DESIGNING FOR SHARED LEARNING EXPERIENCES BETWEEN FACE-TO-FACE AND ONLINE STUDENTS

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This paper introduces the efforts of the CEPSE/COE Design Studio at Michigan State University to design and implement *synchromodal* classes for the Educational Psychology and Educational Technology (EPET) Ph.D. program. *Synchromodal* classes refer to classes in which online and face-to-face students interact during shared synchronous sessions. Our efforts stem from the introduction of a hybrid Ph.D. program in the summer of 2010. In this paper, we describe the antecedents that led to the development of synchromodal classes. We then describe our strategy of a repeated cycle of designing, implementing, and adjusting our realization of synchromodal classes. We conclude by discussing the significance of synchromodal learning in the context of this case and possible future directions for our work.

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OVERVIEW

Orientation and Context

In the summer of 2010, the EPET program at Michigan State University admitted the first cohort of students in its hybrid Ph.D. program. In the on-campus program, students are expected to attend classes and participate in teaching and research in-person on campus. Typically students move to the area for four to five years in order to complete the program. In contrast, the hybrid program is designed for educational professionals who already have full-time job commitments, whether or not they are close to campus. They are required to attend two-week sessions in person on campus for each of the first four summers of the program. The rest of their requirements can be completed online, although students are welcome to arrange additional time to be on campus.

This paper reports on the ongoing efforts of the [CEPSE/COE Design Studio](#) (CEPSE refers to the Department of Counseling, Educational Psychology, and Special Education, and COE refers to the College of Education) to help design learning models in which face-to-face and online students—that is, hybrid students during the online portion of their program—share the same rich learning experiences at the same time. It is important to note that the first author is the director of the Design Studio and the second and third authors serve dual roles as doctoral students in the EPET program and graduate assistants within the Design Studio.

Working closely with program faculty, the aim of the Design Studio is to foster rich interactions among all program members, including faculty as well as both face-to-face and online students. The dominant strategy for blending these groups is by designing what we refer to as *synchromodal* classes and *synchromodal learning*. This paper tells the story of how the different models of synchromodal classes we have designed and implemented so far came to be.

For our program, integrating the two groups of students enables us to offer courses we could not otherwise provide because it eliminates the need to teach courses twice: once

face-to-face and once online. In addition, integrating the two groups makes for a richer learning experience because these two populations often have different perspectives. Face-to-face students generally pay primary attention to their responsibilities as graduate students, focusing on classes and on-campus learning opportunities, as well as to their roles as graduate assistants and researchers. In contrast, online students generally pay primary attention to the applied educational setting of their fulltime jobs; for example, in teaching, administration, development for teaching, and corporate training. They often view their graduate studies as complementing that primary responsibility. In reality, the distinctions between these students are not always so obvious; but generally speaking, the different situations for these two groups foster a rich dialogue of various theoretical and practical issues for teaching and learning.

Antecedents of Sychromodal Learning

Prior to the work of the Design Studio in developing our sychromodal strategy to blend the two groups of students, there were two courses in the EPET doctoral program that necessitated the use of online tools to mediate the learning experiences of face-to-face and online students.

In the Fall semester of 2010, one course design featured video conferencing to allow the students and guest presenters to participate in the synchronous class session from various locations. In fact, because of his busy travel schedule, one of the course instructors sometimes taught from other countries. Furthermore, toward the end of the course, there were sessions that had only one person—one of the instructors—in the physical classroom, while everyone else participated online.

In the Fall semester of 2011, another course also featured face-to-face and online participants. It was designed to accommodate the needs of online students who wanted to take a course that had normally been offered in a strictly face-to-face setting. The instructor had a strong interest in recreating a class environment where students would share, discuss, and debate in small groups. This class feature allowed online students to view, and, with some restrictions, participate in the face-to-face class.

Emerging Need

Through discussion with the instructors and others at the student, faculty, and administrative levels, we began to realize that the press to design and implement courses that could accommodate the learning activities of both face-to-face and online participants was not an anomaly. Other instructors wanted to examine and incorporate ways to bring these two groups together through systematic and consistently reliable methods. Instructors in topics as varied as Design, Statistics, Literacy, Urban Education, Social Networks, and so on, began to come forward with the need

to examine ways of teaching their courses in situations where some or many, though not all, of their students were not physically present. Instructors also began to ask about using video conferencing for bringing in guest speakers and presenters to their class sessions. Others wanted information on how they could manage video conferencing solutions by themselves for more informal interactions. Because teaching sychromodally presented challenges to the instructors' familiar ways of organizing activities and interactions, the Design Studio emerged at Michigan State as a local resource for knowledge and expertise in technology-mediated contexts.

DESIGN INTERVENTION: MODELS OF SYNCHROMODAL CLASSES

Prior to describing in detail the design process behind the conceptualization of each of the sychromodal models, it is important to introduce our general approach to designing the sychromodal models.

Since the Fall semester of 2012, several different instructors had approached the Design Studio with plans and requirements for course designs that would feature a mix of online and face-to-face students participating in synchronous class sessions through video conferencing and other technologies. The varied nature of the course topics, the varied situations of the students involved, and the favored pedagogical strategies of the instructors led the authors—as members of the Design Studio—to hold frequent meetings, both formal and informal, to discuss both the particulars of individual course designs and the features that all the designs seemed to have in common. As such, our design strategy was heavily reliant on conversations among the three of us, along with periodic participation of others, in brainstorming sessions.

In addition, the second and third authors spent extensive time in each of the classes described below. In two cases, those authors were enrolled as face-to-face students and were attending the courses. There were frequent conversations between the instructors and the second and third author before and after class sessions about which elements worked well and which did not. In some cases, conversations occurred with online and other face-to-face students to include their perspectives on what was successful and what needed to be improved. These discussions included all aspects of the class sessions, such as: how well the various activities worked with the technology, what we noticed about class interaction, what would be different about the next class session, and how we could plan for those changes. In turn, the second and third author would report back to the other two authors and, as a team, we would address any emerging challenges and would try to determine what caused those challenges and find appropriate solutions. Some of the challenges involved technical troubleshooting, while others went much deeper.

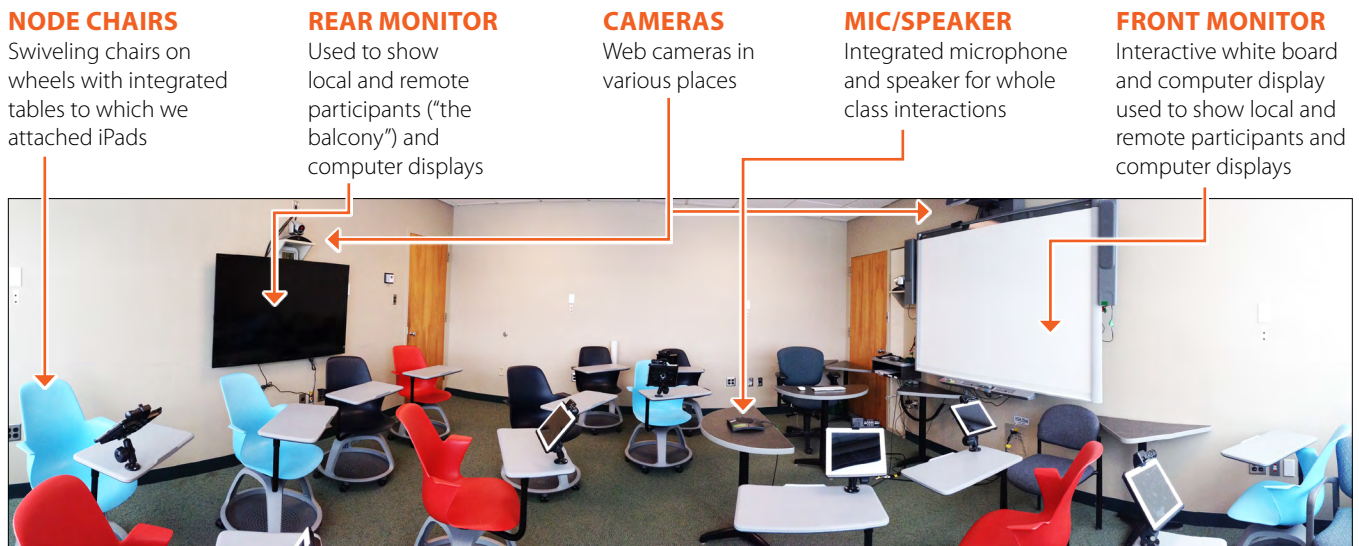


FIGURE 1. Technology in the hybrid learning classroom where most of the synchromodal models were implemented.

What emerged was a working, intuitive sense of how the technology fostered or detracted from certain activities and exchanges between all of the participants in the class. These conversations helped us to articulate and formalize the concept of teaching in the space between purely online and purely face-to-face learning environments—a concept we refer to as *synchromodal learning environments*.

The synchromodal learning environments were implemented in a *hybrid learning* classroom that evolved—and continues to evolve—through this design process. Figure 1 shows the default layout of the classroom and the technology available in that room.

In the following sub-sections we use topographic representations to describe the different configurations of students and interactions in synchromodal classes, including: the *linked class model*, *shared portal model*, *personal portal model*, and *small groups model*. In these sections, we describe and illustrate the four topographies in a sequence that follows our unfolding design journey with this approach. We did not develop the topographic representations until we were a long ways into the development of these models; we created the representations as we tried to make sense of the unfolding models. We include these representations within the narrative for the sake of clarity, and then we provide them all as an overview at the conclusion of this paper.

Each sub-section follows the pattern of Planning and Design, Implementation, and Adjustments. *Planning and Design* focuses on our conversations with instructors and teaching assistants prior to the course as we endeavored to develop technological strategies to support the instructors and students with the desired content using their desired pedagogical strategies. *Implementation* focuses on our experiences of the implementation of the course, with the various

successes, failures, and issues that arose. Finally, *Adjustments* describes our actions to improve the implementation of the course in progress along with the ideas that are emerging from this design and implementation process.

Linked Classroom Model

Planning and Design

During the spring of 2012, an instructor approached the Design Studio about solving a unique teaching challenge for a course he would be teaching during Fall 2012. Generally, conversations with faculty have begun during the semester prior to when a course is taught, although some interactions have been longer, and a few have been more urgent. Having a full semester during which to prepare has generally been sufficient. This instructor was planning to teach a course for which he had two groups of students in two different cities—roughly an hour’s drive apart from each other—who were interested in taking the course. Ordinarily, he might have simply traveled to each location for the class sessions, in effect teaching the same course twice a week. For this class, he wanted to know if we could make it possible so that he could teach the class once a week to both groups at the same time. His hope was that he could alternate his location, so that both groups sometimes experienced the instructor unmediated and sometimes mediated via the Internet.

Implementation

Figure 2 shows the topography of this model in which two face-to-face classrooms are linked via the Internet. In this and the following figures, solid lines represent face-to-face interaction whereas dashed lines represent virtual (i.e., online) interaction. The solid blue shading inside an ellipse represents unrestricted face-to-face interaction among participants. That is, each participant in that ellipse could

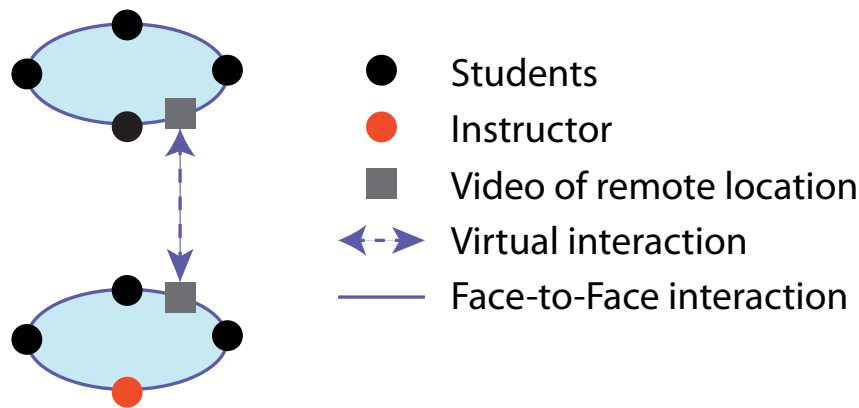


FIGURE 2. Linked Classroom topography.



FIGURE 3. Linked Classroom face-to-face classroom view with PowerPoint presentation inset as part of the main video feed (see dotted circle).

directly see and be seen by, hear and be heard by, all of the other participants in that ellipse.

Figure 3 illustrates two students of about ten who were gathered in their own face-to-face setting looking at the other group via live video and audio over the Internet. The figure also illustrates the fact that the entire remote group was made visible via a single camera whose image appeared on a single screen. On the wall monitor is a video of the remote classroom. Students can be seen sitting around a conference table; the instructor appears in front of a projector showing his PowerPoint presentation at the far end of the table (see dotted circle in the diagram).

For this class, there was a single speaker/microphone for the group at each location. Local participants could see and talk

with each other; they could also be seen and heard by participants at the other location, albeit in a relatively small image on a large display. We came to call this model the *linked classroom model*.

We initially used a Polycom system to support this linked classroom model. *Polycom* is a high quality and relatively expensive video conferencing technology; in our case, the system cost just over \$10,000 plus an annual maintenance agreement that cost over \$1,000. In the base setup, Polycom supported just two locations, both of which needed to have the system. One of the very useful features of Polycom is the support for multiple cameras at each location (two in our case) as well as the ability for local and remote participants to pan and zoom those cameras, making it relatively easy to zoom in on the instructor or individuals, or to view the class as a whole. Polycom also supported sharing a computer image, although we primarily depended upon the computer image being visible through the cameras.

During early sessions of this course, we faced significant audio problems. Sometimes it was extremely difficult for groups to hear each other. After repeated conversations with technical support at both locations, the

problem was resolved and communication between the two locations worked quite well.

Adjustments

Despite the affordances of the Polycom system, after several class sessions we switched to a different video conferencing system, *GoToMeeting*, an Internet-based video conferencing tool that allowed up to six video signals and up to 25 audio signals in a meeting at once. The initial prompt for this change was the desire of the instructor to bring in a presenter from a third location. Since our Polycom system did not support this, we explored alternatives and choose to use *GoToMeeting*. Unexpectedly there were also beneficial side effects of this change. In particular, *GoToMeeting* was



FIGURE 4. Linked Classroom online participant view.

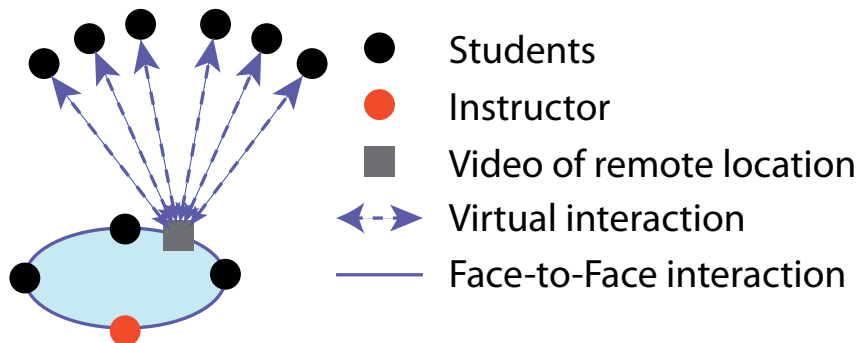


FIGURE 5. Shared Portal topography.

simpler to use, offered comparable quality, and was dramatically cheaper. GoToMeeting cost us as little as \$250 per year using a webcam and audio devices, which combined, cost us less than \$500.

Figure 4 shows the view that all students had of the remote participants in GoToMeeting. The main part of the window (in blue) is a PowerPoint presentation, and across the top row one can see the local classroom, the remote classroom, a guest presenter, and the course instructor.

Overall, this linked classroom model seemed to work quite smoothly. After getting used to GoToMeeting, few additional hurdles were encountered, and the instructor anticipated continuing the model with little change in future semesters.

Shared Portal Model

Planning and Design

Prior to that same semester, another faculty member approached the Design Studio to request advice and technology support for an upcoming course. He was planning to teach a doctoral-level seminar on design and the students who had enrolled for the course included both face-to-face and online students. The course became the second synchromodal course the Design Studio would support that semester. It would be comprised of a face-to-face group of nine students and two instructors that also met face-to-face, in addition to a group of ten online individuals who connected to the face-to-face group using what we came to call the *shared portal model*. Figure 5 shows the topography of this model in which a group of people are face-to-face, and online individuals are represented together on a shared audio and video channel.

From the beginning of the discussions between the course instructors and members of the Design Studio, it was clear that this new course design would be a unique challenge. First, this course included a comparable number of face-to-face and online students, but, whereas the online students were all together

in one place in the first model, in this course the online students were physically dispersed. In addition, the instructor wanted times of rich dialogue between both groups of students, both as a whole class and among small groups. In contrast, the first model made greater use of presentations of material than class interactions. The design team felt it was crucial to find pedagogically sound methods of mediating through technology between the two groups. The success of the interactions, presentations, and discussions in this course would hinge on the viability and performance of the technology.

Furthermore, the instructor designed the course such that these synchromodal dialogues were central to the course. In other words, mediating synchronous class interactions

TRIPAD

An iPad mounted on a tripod, used to give the online participants a more authentic “face-to-face” perspective on in-class activities and discussions.

INSTRUCTOR STATION

Instructor seated toward the front to coordinate activities such as screen sharing and whole-class discussions.

SECONDARY MONITOR

Used to support more flexibility in the view offered to students in the face-to-face class.



FIGURE 6. Shared Portal face-to-face classroom view.

through technology was not viewed as a novelty or peripheral element of the course design, but a central element that required careful planning, monitoring, and refinement. Making these interactions effective was core to making this class a success.

Despite these challenges, the timing was excellent to try this particular course design. One of the graduate research assistants in the Design Studio was actually enrolled to take the course; this meant the instructors would have the benefit of real-time technical support from someone with first-hand knowledge of the technology and how it was to be used. This student, the third author, would be in a position not only to observe how the technology performed under real class conditions, but would also be able to lend real-time technical support and troubleshooting. This role became later known as *technology navigator* (hereafter, tech navigator; Bell, Cain, & Sawaya, 2013). Tech navigators have come to play an integral role in the implementation of synchronodal classes.

Implementation

For the face-to-face students, the experience in this class was much like the experience of the group in the linked classroom model where the instructor was physically present. That is, the face-to-face students and instructor could directly see and interact with each other, and the online students could be seen and heard on the display. Figure 6 shows a view of the face-to-face classroom with a description of the unique features.

What made this model different from the *linked classroom model* was that the online participants were seen as a mosaic of individual webcams aggregated on the display rather than appearing as a group of participants in a single room. Figure 7 shows the view seen both by the local classroom

and the online students. In the top center is a view of the local classroom. Surrounding this image are videos of various online students who were physically scattered around the country. The white box at the bottom of the display is the instructor's computer that had at this point been reduced in size in order to maximize the view of online students. Since the online students were represented as sharing a single display in the classroom, we referred to this model as the *shared portal model*.

For this model, we primarily used GoToMeeting for whole-class discussions. The instructors envisioned a course that had equal measures of whole-class and small group discussion and interaction. For the whole-class discussions, the biggest advantages of GoToMeeting were its reliability and its simplicity for both set up and student access. We also had very little trouble with audio feedback—one of the most common and annoying concerns about video conferencing from multiple locations—in this model, either from on-campus or online devices.

Despite the overall success of this model, we ran into two major issues during its implementation. First, given the number of online participants in this model, we found the biggest disadvantage of using GoToMeeting was its limitation of six simultaneous video feeds. Up to 25 audio streams could run simultaneously, so many participants could listen and talk, but since our normal setup included using two video streams to show the face-to-face session, only four online students were normally seen at any one time. One way that we addressed this limitation was that one of the co-instructors would at appropriate times turn off an online student's video and request another to enable their webcam. By doing so, it was possible to include a range of online participants, yet this restriction was still quite limiting.



FIGURE 7. *Shared portal* online participant view.

The second implementation issue involved the small group interactions during the sessions. As stated above, the interactions among students and instructors were evenly split between whole-class and small group activities and discussions. The instructors wanted the small groups to be comprised of both face-to-face and online students. They also purposely intended for each group to find its own preferred methods of interacting online, be it through another video conferencing platform like Google Hangouts or Skype, or through some other means like chat rooms or simultaneously edited documents such as Google Docs and EtherPad.

Surprisingly, finding an appropriate physical space for the face-to-face participants proved challenging because the classroom we were using was not large enough to hold multiple, simultaneous videoconferences. This was because the audio technology was not as good at differentiating the conversation in one group from another as the human ear, so the groups had to be more isolated from each other than purely face-to-face groups must be. Finding a physical place for face-to-face students to meet took extra time while online students did not have to move. In the future, it will be necessary to plan so that students can find a secluded location nearby to conduct these small group interactions.

Adjustments

We made one major adjustment to the technological set up of this model during the class. One of the concerns by the main instructor was what view of the class was being presented to online students. He felt dissatisfied with having a webcam pointing over the instructors' heads to the rest of the class, since the original design had a web cam mounted

on the top of the large class monitor. Through conversations with him, we tried various models, including a wide-angle webcam that was mounted on the side wall of the classroom so that the hybrid students could see the face-to-face students as well as the instructor who was addressing the class. These changes seemed to help, but there was still dissatisfaction with the effect.

One of the creative ideas that arose within the classroom setting was to have a second camera that could give more of a student perspective of the class that would be projected along with the whole class perspective. As such, online students then had two views of the classroom. One

camera was used to show a wide-angle view of the entire classroom that was intended to give them an overall feel for the class. We then used a second webcam—the *student cam*—focused on appropriate participants in the class, whether that was the instructor or some other individual who was speaking at the time.

The student cam was controlled in multiple ways. Sometimes it was simply a fixed webcam in an appropriate location, such as front and center aimed at the instructor who was speaking. When the instructor rarely moved and others rarely spoke in the class, this approach was sufficient. Another approach was to have the student cam be a device controlled by an in-class participant, such as a laptop computer or an iPad on the student's desk. The student could then redirect the camera to point to an appropriate place in the room, since the desks swiveled and were on wheels. A third approach was to use a *triPad*—an iPad mounted on a tripod as seen in Figure 6. Multiple participants then took responsibility to move the triPad around the classroom so as to point toward the most appropriate focus, a focus that changed based on the interaction in the face-to-face classroom.

Personal Portal Model

Planning and Design

The shared portal class described above had an equal and relatively large number of online and face-to-face students. For that course we used a relatively simple approach based on the instructor's desire to have class run as smoothly as possible with minimal technology issues.

So when a smaller synchromodal course on Literacy was offered the following semester, we initially chose to keep the same shared portal approach. We were comfortable with this model, and the second author was the tech navigator in the class as well as a student. The online students were also comfortable with the model, and after a semester-long testing phase, we felt confident in implementing and troubleshooting this model.

It was not long, however, before we were prompted to continue exploring new models. A few weeks into the new semester, we were discussing the shared portal model during one of our weekly Design Studio meetings. We had collected preliminary data from earlier classes regarding students' perceptions of the class dynamics and we were surprised to learn that students who were online sometimes felt they had a more individualized presence within the whole class discussions as compared to face-to-face students. We had expected that online students would feel less like individuals since the instructors could very easily turn to, address, and ask questions of the face-to-face students, making eye and verbal contact without mediation, whereas online students would appear right next to each other on the screen, and their voices would all come from the same speaker. As we were puzzling over this surprise, we began to realize that the instructors would often seek the input of online students directly and by name. When they spoke, the attention of all students, both face-to-face and online, was directly on them. In contrast, the face-to-face students saw their images aggregated in a single frame that was the same size as the frame occupied by individual online students, and as such it seemed to reduce their individual presence within the combined classroom space. In addition, the technology provided a chat back-channel that was visible to everyone but was only available to online students. Using this back channel, the input of online students was always connected with their names as individuals and provided an easy means for their continued contributions to the class. Although correlations were not formally established, we sensed that the individual appeals for online student participation, the repetition of their names both in the chat and by the instructors, and the aggregation of the images of face-to-face students may have influenced how all of the participants regarded each others' roles during the class sessions.

Given the conversations that unfolded with these issues, we wanted to explore a new strategy for having students interact in the synchromodal environment in which online students would see from and be seen within their own individual locations in the

class. Accordingly, we were on the lookout for an opportunity to experiment with what we have come to call the *personal portal* model. We decided to approach the instructor of the Literacy class since he preferred the seminar approach to teaching in which there was a fluid give-and-take between students and instructor. The shared portal model made this possible, but it seemed not to be a great solution, since online students were relegated to a single portal together, as if they were in the balcony area overlooking the more fluid give-and-take of the face-to-face students. The face-to-face students sat in a semi-circle around the instructor and had their backs to the screen shared by the online students. The online students expressed that they did not feel like an immediate part of the class. Since the Literacy class had three online and six face-to-face students, we decided to experiment with our unfolding ideas regarding integrating online students within the face-to-face environment. Figure 8 shows the topography for this approach. In this model, each online student was given his or her own device within the face-to-face classroom, hence the name, *personal portal*.

We chose to test the use of iPads mounted on the Node chairs in the hybrid learning classroom. We theorized that in the same way the large Front Monitor served as a shared portal for *all* the online students, the individual iPad screens would act as personal portals for them. With this approach, we were hopeful that the online students would be integrated into the fluid give-and-take of this seminar format class. The goal behind this synchromodal class model was to approximate more closely the experience of a traditional face-to-face large group setting. We decided to address this issue by making use of iPads in the room.

Implementation

Figure 9 depicts how the personal portal model appeared to students in the face-to-face classroom. Using this approach, the online students each had their own personal portal (i.e., the iPad), giving each of them their own visual and audial presence. In contrast, in the shared portal model the online

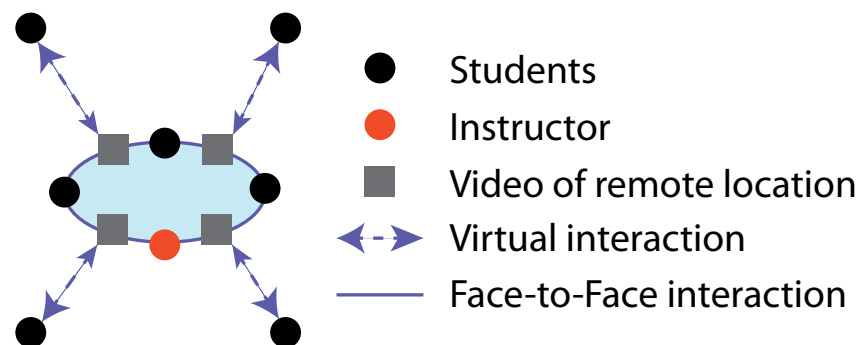


FIGURE 8. *Personal Portal* topography



FIGURE 9. *Personal Portal* face-to-face classroom view.

participants were all displayed in the same physical space, and their voices came from the same speaker.

In terms of technology, we used iPads mounted to Node chairs. Individual online students would place a video call to a particular iPad, and a local student would serve as a *buddy* or *advocate* for the online participant. The local buddy was responsible for ensuring the connection with the online person and for turning the desk so that the online participant could see the relevant in-class activity. We primarily used Skype for this connection, but FaceTime and other technologies would be expected to provide similar results. We favored Skype since we already had good experiences with Skype, and we did not want to restrict what technology the online students could use for their connection, since FaceTime did not work on the various equipment in use by our online students.

By setting up a Skype account on each iPad and having the online students place a call to the appropriate device, not only did they occupy their own physical space in the class, they also acquired their own *eyes*, *voices*, and *ears*. Each of the online students received a different visual experience of the class since each had their own iPad webcams. This was similar to each of the face-to-face students having different visual experiences of the class, each from their own angle. In addition, each of the online students had a personal audio channel. Each one was heard through a unique iPad speaker and each received sound from an individualized iPad microphone. This is analogous to face-to-face students

having their own voices and ears, respectively.

Moreover, one of the key features of face-to-face seminars is how the group negotiates who *has the floor*. In general, there is a lot of back and forth as students interrupt each other, sometimes within a paragraph (so to speak) and sometimes mid-sentence. When implementing the personal portal model, we noticed an increase in the instances when online students would interrupt face-to-face individuals or even other online students while speaking. This was an improvement from the shared portal approach where the online students would only speak when the instructor explicitly directed the conversation towards them, or sometimes after asking permission to speak (e.g., “Excuse me. Is it okay if I add something?”).

Despite being an improvement over the shared portal model in terms of giving online students their own presence in class, the personal portal model brought several issues that were not present in the latter approach. These issues are also reported in Sawaya, Bell, and Cain (2013).

The online students had limited visibility of the instructor’s screen, their face-to-face student advocates, and the other online students. Previously, in the shared portal model, the online students had full visual access to the class through the lens of the wide-angle camera that showed a bird’s-eye view of the entire classroom. In addition, the online students saw other online students as well as the instructor’s shared screen directly and clearly through GoToMeeting. So online students preferred some aspects of the shared portal model. On the other hand, the face-to-face students and the instructor voiced how much they enjoyed seeing the faces of the online students scattered within the class with the personal portal model.

In addition, the online students were completely dependent upon their face-to-face advocates to direct their class experience. Unfortunately, there were several instances when a face-to-face advocate would forget to steer the Node chair towards the conversation, leaving the online student stranded looking at a wall or at an individual who was no longer speaking.

Furthermore, Skype was not completely reliable and there were times when the video call would drop, leaving the

PERSONAL PORTAL

An online participant connected to an iPad mounted to a Node chair

SHARED PORTAL

Online participants in a shared portal through GoToMeeting

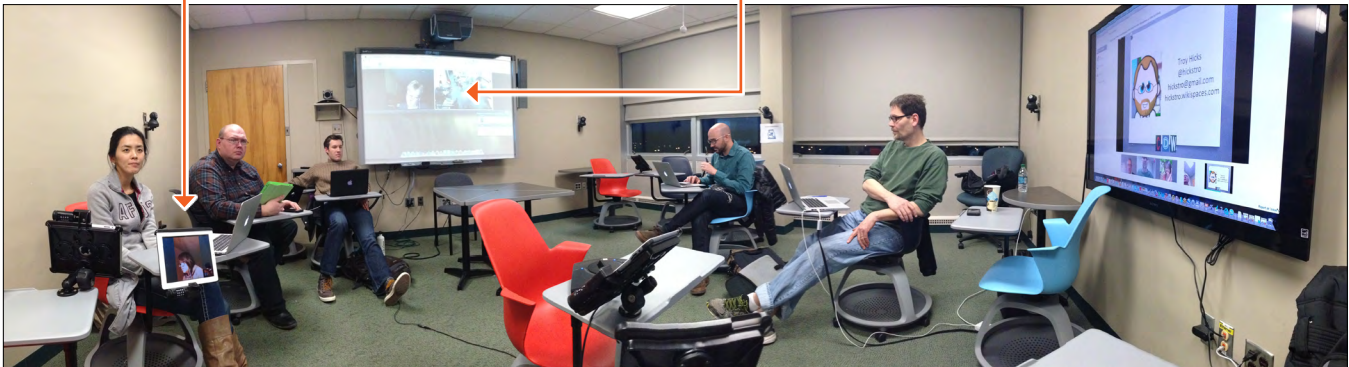


FIGURE 10. *Enhanced Personal Portal* face-to-face classroom view.

online students without a means of communicating with or accessing the class. Having only one means of connection to the face-to-face class made online students vulnerable to a single point of failure, a failure that occurred at least a few times. At one point, it took 15 minutes before the online student was able to reestablish the connection with the class.

Adjustments

To address the above issues, we decided to combine the shared portal and personal portal models to enhance the experiences of both the online and face-to-face students. We called this model the *enhanced personal portal* model, as it was an adjustment to and improvement upon the personal portal model. So in addition to having the online students use Skype to join the class (i.e., personal portal), we also asked them to join GoToMeeting in order to regain a full-class view. Figure 10 shows the face-to-face classroom view for the enhanced personal portal model with descriptions of the unique features.

Small Groups Model

Since the course mentioned above only had a total of nine students, three of whom were online, we were easily able to make adjustments to the shared portal and personal model models. Another course that same semester, however, had fifteen online and seven face-to-face students. Since the instructors for this course had a different instructional strategy, a fourth synchromodal class model was implemented: the *small groups model*.

Planning and Design

The instructors for this course chose to put the greatest emphasis for learning on small group interactions and discussions between students. Since the majority of the students would be online, it was crucial to design a technology

configuration that would allow multiple small group discussions to take place in the same place at the same time. Moreover, the instructors wanted all students, face-to-face and online, to switch periodically from one group to another in order to encounter a wider spectrum of perspectives and interactions.

Figure 11 shows the topography of the small group model. When comparing this to Figure 2, there are some important differences. In particular, two of the small groups of students (represented by the right two ellipses) are shaded half with blue and half with gray, and the lines of the ellipses are half solid and half dashed lines. In these ellipses, the right-most dot represents a student who is online while the other three dots are face-to-face students. Hence, there are solid lines and blue shading on the left half of the ellipse since these students are interacting unmediated (i.e., face-to-face). The right-most student is also a part of this small group of students, and can also see and be seen by, hear and be heard by, all of the students in the group, albeit through the Internet—hence, the dashed lines and gray shading. In addition, the instructor, the red dot, is able directly to interact with this group by physically moving to the location of those students who are physically present, using the technology in order to interact with the online student.

In contrast, the left two ellipses represent the case when all students in the group are online, so the lines are all dashed and the shading is gray. Hence, they can interact with all of the other members of their group, yet all of their interactions are mediated by the Internet. In addition, the instructor can interact with this group via technology, hence the dotted line from the instructor's red dot to the ellipse.

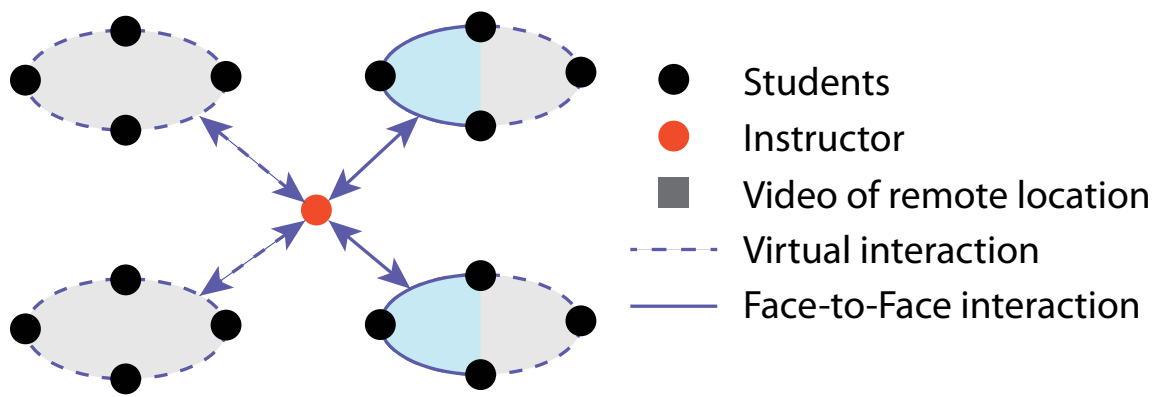


FIGURE 11. *Small Group topography.*

Implementation

Initially, the technology for synchromodal small groups was a combination of GoToMeeting for the whole class activities and Google Hangouts for the small groups. The class began in the room we had used for the other synchromodal course designs. Discussions were held on individual iPads, with several face-to-face students on each device using earphones and an audio splitter to join the separate Google Hangouts. Each Google Hangout required its own separate Google user account, which the tech navigator set up prior to the beginning of the course.

Because of the complexity of the design, it was clear that a tech navigator was required to provide in-class support during all class meetings. The third author took on this role and was responsible for setting up the technology beforehand, including setting up the cameras and speaker/microphone, opening the GoToMeeting conferencing system, and logging in to each of the Google accounts on their corresponding computers. In addition, because the online students each needed to use two devices during class sessions, he was also responsible for contacting each student and conducting a test run of their use of the equipment and applications prior to the first class session. Finally, the tech navigator provided technical support and troubleshooting during class. Once again, he was able to make in-class observations and report to the Design Studio team on how the technology performed and how well it supported the instructors' pedagogical strategies, focusing on the interactions among the participants in small groups.

As noted above, the design required online students to use two separate devices simultaneously. Since all online students received an iPad at the beginning of their program, they were asked to log in to GoToMeeting on this device while also logging in to the appropriate Google Hangout on their own computing device. A course website was used to inform all the students which small group discussions they were to attend for each class session.

Adjustments

During the implementation phase, we ran into several issues. Providing a reliable set of audio solutions was the greatest challenge. The instructors wanted periodically to address the entire class to elaborate on certain key topics and concepts. The initial plan called for GoToMeeting to be the central hub for all whole class discussion and instructor presentations. As such, the GoToMeeting session would always be running, even when small groups were interacting in Google Hangouts. However, the online students reported that the omnidirectional speaker/microphone connected to GoToMeeting tended to pick up too much extraneous noise when small group discussions were taking place, causing unwanted distractions.

Google Hangouts proved to be a good solution for this particular course design. It worked easily and effectively for groups of four to six participants. It was also readily and freely accessible for students to use on their own. One downside of using multiple Google Hangouts simultaneously, however, was that students sometimes struggled to find the Hangout they were supposed to be in. In general, the transitions from one technology or meeting space to another were the times of greatest difficulty for online students, and Google Hangouts in particular was challenging since there is not a standard address or meeting number that will reliably get students into the right virtual meeting space (Cain, Sawaya, & Bell, 2013).

After the first class, it was decided that a larger room was needed. Face-to-face students remarked that having more than one person use an iPad for the same Google Hangout session was physically awkward since they had to sit so close together in order to be seen by online participants. Switching between the Hangouts hosted on iPads was also a challenge because it was not immediately obvious which device was hosting which Hangout. Furthermore, both online and face-to-face students reported difficulties with the sound quality, owing to the small size of the room and the way the iPads handled more than one audio output.

GOOGLE HANGOUT STATIONS

Where small group discussions were hosted with 1 face-to-face student and multiple online students

GOTOMEETING VIEW

A local view of what online students saw, including 2 views of the overall classroom plus 4 individual students

INSTRUCTOR

The instructor (who was face-to-face) speaking to local and remote students simultaneously



FIGURE 12. *Small Group* face-to-face classroom view.



FIGURE 13. *Small Group* online participants view.

A larger room with eight separate iMacs was used for the rest of the class sessions. Using desktops instead of iPads allowed for more stability (e.g., Google Hangouts on iPads ended if no one else had joined), the iMacs handled audio better, and the new classroom already had iMacs installed. The Google accounts were numbered by their user names and the separate desktops in the classroom were also numbered so that each Hangout was hosted on a correspondingly numbered desktop. This numbering, along with the scheduling on the

course website, allowed both online and face-to-face students to know which Hangout they were supposed to attend, in what order, and with which participants. The larger space also allowed students to move more freely between the different Hangouts, while the larger screens offered greater visibility and camera coverage for both face-to-face and online students. We continued to use GoToMeeting for whole-class and instructor views along with an omnidirectional speaker/microphone for audio input and output.

Figure 12 shows the technological setup of the small group synchronodal model. The figure also shows a typical moment in the synchronodal small group model. The students shown were spread to the far reaches of the room since they were talking with online participants in small

groups rather than to other face-to-face students. Face-to-face students generally wore headphones so as to minimize audio interference with other groups. In this particular image, one of the instructors, standing in the middle of the room, alternated between addressing the whole class and participating in individual small groups, both physically and virtually.

Figure 13 shows a typical view of online participants. The top-left image shows a view of the face-to-face classroom looking toward the students (from behind the instructor) while the lower-left image shows a view of the instructor (as a face-to-face student might see it). The other four images are online students who are in a small group together.

In almost every way, the small group model for a synchro-modal course was the most difficult to design, implement, and maintain. The pedagogical strategy used by the instructors meant there were many active and changing elements in each class that needed attention and awareness from all participants. As such, several concrete lessons were learned about the design and implementation of this particular model.

First, students needed to be able to switch between small group discussions easily and without confusion. Much of the early difficulties resulted from students not knowing which conferencing platform to use (GoToMeeting or Google Hangouts) at which times, and with which groups (small or whole-class). In addition to verbal cues from the instructors and the group schedules posted on the course website, it would be helpful to have a separate, web-based “alert” system that would make transition times more explicit and allow students to know which groups they should join next. The first author is in the process of creating and testing such an application.

Second, pre-course orientations needed to be better planned to help students understand how the technology will be used and what roles and responsibilities the students have in the use of that technology. The third author conducted one-on-one pre-course orientations for each of the online students. A better approach in the future would be to have orientations with several students at the same time, perhaps including some of the face-to-face students as well. This approach would more closely approximate the actual rhythms of managing two devices simultaneously and transitioning quickly between small group sessions.

Third, this synchro-modal model needed a stronger audio solution than the one used for the other models. The design required at least eight separate audio devices in the classroom to be working simultaneously and in relatively

close proximity. Making sure everyone could hear what they needed to hear while keeping distractions and confusion to a minimum was a constant challenge. An optimal audio solution should let the instructors address everyone simultaneously when needed but still allow students to carry on small group discussions without interference.

Summary of the Synchro-modal Models

Figure 14 provides a visual summary of the topographical representations of each of the different synchro-modal models. Again, it should be noted that this summary of models emerged through the process of supporting a range of courses in this new approach of combining face-to-face and online students.

We expect that we will continue to adjust and enhance these models each time a course is taught. Changes in technology, the purposes and pedagogy of each course, and changes in both the students and the instructors will bring new possibilities and new challenges. In addition, we expect that we will continue to explore new models for the uses of technology to support both face-to-face and online participants as shared course experiences.

ON THE TERM SYNCHROMODAL: EMERGENCE AND DEVELOPMENT

Our understanding of, and terminologies for, these models developed even as we were implementing them. We felt it was important and necessary to explore the emerging course designs from a research perspective. As a first step, we decided to develop a topographic model that would help describe different flows of communication and interaction. This process took several months of trial and error as different visual models and representations were tried and modified. Determining a set of visual cues that could be used as a kind of iconographic vocabulary for describing interactions between online and face-to-face class participants was a major achievement. Once a vocabulary had been established, it simply became a matter of applying those terms to the class models we were familiar with. That was how we coined the terms *linked classroom*, *shared portal*, *personal portal*, and *small group*.

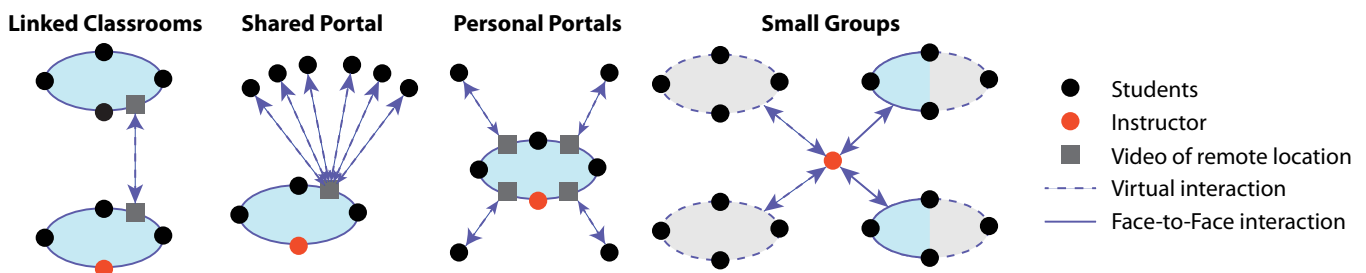


FIGURE 14. Synchro-modal Models topography summary.

After applying our visual vocabulary to various class models, we then recognized the need for a term to describe the concept of teaching in the middle space between online and face-to-face modes of instruction. Terms like *hybrid* and *blended* had already been used to describe course designs that alternated between face-to-face and online elements. We felt that the interactions we observed in the new course designs, however, were quite different from simply switching between the two modes. The new course designs made a deliberate attempt to merge the two modes in a synchronous fashion—hence, after lengthy deliberation, the term *sychromodal* was proposed and adopted. The term actually has its roots in the field of logistics, where it is used to describe planning strategies that leverage a variety of transportation modes to achieve a single cohesive logistics solution.

CONCLUDING REMARKS: SIGNIFICANCE AND MEANING

It is our expectation that hybrid learning, in all of its forms and especially the sychromodal class models, will become increasingly common in a range of courses. We are also convinced that the advances of technology will make this approach increasingly accessible and effective. In our efforts to provide innovative technological strategies in support of the pedagogical strategies adopted by various instructors, some ideas have emerged that we plan to continue to explore as new courses are taught and new models are employed.

Evolving Technologies

A challenging but also positive reality is that technology is always changing. The downside is that there were times when a solution that worked one semester did not work the next semester. Or even when the technology was available, it sometimes involved a different interface or required a different teaching strategy in order to be effective. The positive side is that new and improving technologies may enable solutions previously unavailable. Ideally, the same tool becomes better without requiring us to switch technologies, although that was not always the case. Unfortunately, these changes also required us to always be watching technology both for changes to, or disappearance of, existing tools and for new tools that might help us do things better.

Preparation and Risk Tolerance

These sychromodal classes required additional planning work as compared to either face-to-face only or online only courses we had worked with before. The additional complexity and required coordination made it harder to adjust strategies midstream.

Nevertheless, because of the nature of the contexts, it was not possible to anticipate all of the issues, and not all

difficulties could be avoided. As such, knowing one's own risk tolerance and that of the instructors and assistants was critical. We anticipated that some approaches to sychromodal classes would be more likely to fail than others, yet when they succeeded they brought much good. We have learned that some faculty were more willing to tolerate potential troubles while other faculty were more inclined to use more "tried and true" methods. We have become convinced that the critical element is for faculty, and those helping them, to know which strategy will be best for each situation.

Technology Works Best When It Fits

Another key idea we are learning is that technology works best when it fits our use for it. A hammer is great for pounding in nails but not screws, whereas a screwdriver is pretty useless for nails. In the case of educational innovations, if we lead with a solution rather than with a clear understanding of what we want the solution to do, we are convinced we will only succeed by chance. Through interactions with different faculty on difference courses, we have seen that none of these models could have been best for everyone. The courses ranged in the degree to which the primary need was for students to master a large body of content, or to interact with other students while solving problems or addressing challenges, or to interact with faculty over challenging questions and issues, and so on. What worked in one of these contexts could not have been expected to be very effective in another. Knowing our purpose, why that purpose really matters, what alternative technologies and pedagogical strategies might support that purpose, and how these alternatives compare was an important strategy to maximize the likelihood of success.

Pedagogy Drives Technology

To guide this effort to make the technology fit the context, the [TPACK model](#) emphasizes the interconnectedness between the content, the pedagogy, and the technology. As we worked with faculty, there was generally a preferred pedagogical style they wanted to maintain as they moved into the sychromodal models. Endeavoring to match their pedagogy with the appropriate technology seemed essential, even as we engaged faculty in the conversation regarding how their pedagogical strategies might be adjusted given the potential that new technologies may provide.

Tech Navigator

One of the most valuable strategies we have discovered was to assign a tech navigator to a class (Bell, Cain, & Sawaya, 2013). The tech navigator's responsibility was to oversee the technology and associated pedagogy so as to free up the instructor (and possibly the TA as well) to give primary attention to the content and student learning. Our tech navigators had been doctoral students in EPET, so they knew the technology and they had a rich appreciation for

the pedagogical strategies and setting of the class. We have seen that having to think simultaneously about the class, about students who are experiencing the class in multiple settings, and about troubleshooting technology is incredibly difficult and stress inducing. Having a tech navigator who can take some of these burdens from the instructor has been a great help to instructors and has given them much greater confidence going into a class with one of these models.

In addition, being a tech navigator has been a tremendous experience for our doctoral students. They have had the opportunity to be a part of faculty conversations in planning how a course is taught and how those strategies are implemented with the available technology. In addition, they have been a part of the conversations when faculty have made mid-course corrections based both on how the technology helped or hurt learning and on the general pedagogical strategies in the class. We expect that this experience is one of the best preparatory experiences for students who one day will likely be teaching in a synchromodal setting.

Keep Learning

Finally, our assumption is that we must never be done learning, and we have found valuable insights by studying our own work. Our approach in supporting faculty with synchromodal classes is to find whatever opportunities we

can to gather data both for evaluation and for research. We want to inform our own practice, and we want to be able to share what we learn with others. So we have employed a variety of strategies to gather data from students including observations, in-class surveys, after-class surveys, and dialogues with faculty.

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