



UNIVERSITY OF CALGARY | WERKLUND SCHOOL OF EDUCATION

DESIGNING FOR TECHNOLOGY-ENABLED LEARNING ENVIRONMENTS

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Designing for Technology-Enabled Learning Environments

Abstract

This working document is for instructors designing technology-enabled learning environments. Six possible approaches for course delivery consideration are illustrated. Each approach highlights some possibilities, requirements, challenges, scenarios, and related literature references. With each scenario, consideration for context (class size, location, etc.), pedagogical approach, and resource accessibility is recommended.

Keywords: blended learning, online learning, hybrid learning, instructional design, higher education

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Overview

The COVID-19 global pandemic has disrupted learning worldwide with higher education institutions adopting online models for course delivery at an accelerated pace (Pelletier et al., 2021; Bozkurt et al., 2020). Instructors can be challenged to design for technology-enabled learning environments and facilitate student learning in the classroom and online. A typical on-campus classroom can include a podium for the instructor with connectivity to a projector and audio in the room. In some technology-enhanced classrooms on-campus, additional equipment can include multiple projectors, microphones, video cameras, breakout spaces equipped with monitors, high-quality audio systems, professional-grade software programs, LMS systems with digital assessment tools, data analytics, and more (see Table 1). With this significant complement of technology, it is important for instructors to familiarize themselves with their rooms in advance of class start-up. This working document is for instructors designing on-campus learning in a classroom space that can have a typical room set-up or possibly additional technologies available in the room and a technology-enhanced set-up. This document provides six approaches for course delivery consideration that could be adapted/combined for different teaching circumstances and to support student learning in the classroom and online. Each approach highlights some possibilities, challenges, scenarios, and related literature. The document does not include all possible scenarios and terminology used in the literature for merging modalities but can be useful for dialogue. With each scenario, consideration for context (class size, location, etc.), pedagogical approach, and resource accessibility is recommended.

Note: Course modality changes (location/scheduling) or questions related to instructional hours should involve consultation and approvals from the faculty.

Guiding Questions

These guiding questions may be used to facilitate discussion when considering the scenarios provided in this document.

- What are the benefits or challenges described in the scenario?
- Are there other benefits or challenges with the scenario or with this approach that have not been identified?
- If the scenario describes a challenge, what are some strategies that could be employed to avoid or mitigate the challenge described in the scenario?
- If the scenario describes a benefit, what are some strategies that could be employed to enhance or extend the benefit described in the scenario?
- What are other scenarios that might be expected when using this approach?
- What supports would you need to help you with this approach?
- What other questions emerged from the discussion of this approach?

Table 1

Typical On-Campus Room Set-Up and Possibilities for Additional Technology-Enhanced Set-Up

Typical On-Campus Room Set-Up	Technology-Enhanced Set-Up
<ul style="list-style-type: none"> • Podium access to one computer with built-in webcam and microphone. • Option to connect instructor's computer • One projector to screen share with on-campus students. • video/audio conferencing software (e.g., Zoom). • LMS platform. • Document Camera. 	<ul style="list-style-type: none"> • Mobile device or easy-to-use audiovisual equipment for managing audio/video input/output selections. • Physical space is intentionally designed to support learning objectives and task design desired. Multiple stations are available for project work, independent study, online tasks, and small group instruction. • Speakers and dropdown microphones installed to provide optimal audio quality. • Multiple forms of educational technologies are present, such as mounted televisions, large tabletop white boards, and tablets. • Devices can be connected, and power sources are nearby. • Workspaces are equipped for students to actively collaborate in groups of any composition (moveable whiteboards, interactive boards). • Multiple projectors so multiple screens can be displayed, such as instructional materials, virtual attendee profiles and an area to share/present work. • Video cameras set up and linked to video/audio conferencing software. This provides students joining online to see all aspects of the classroom. • Digital assessment tools that can be used to inform daily instruction. • A teaching assistant is available to support students both on-campus and online (join breakout rooms, circulate in class, support LMS discussions and tasks).

* Note: The typical room set-up is based on classrooms located in the Education Complex at the time of publication.

Course Delivery Approach #1: Multi-Access

Multi-access “has been recognized as an overarching framework that can broadly incorporate many different configurations of merging modes,” including face-to-face, synchronous online, and asynchronous online (Irvine, 2020, p. 49). In this design, the instructor facilitates learning for students who are present in the on-campus learning space and for those who are online using video/audio conferencing software (e.g., Zoom).

Benefits:

- Improved flexibility for learners to move from in-person to remote learning
- Increased access to learning thus attracting students from a wider range of locations, including internationally
- Potential to reduce instances of extended absence/course withdrawal
- Potential to increase flexibility for students dealing with situations of illness or unforeseen circumstances

The Challenges:

- Need to arrive early to set-up and test and have time following class to shut down
- Reliability of technology
- Providing high-quality learning to learners in two different spaces synchronously
- Ensuring learning resources are compatible for both remote and face-to-face learners

Potential Scenarios:

1. Instructor tries to teach both groups (on-campus and online) at the same time synchronously in a technology-enhanced room. The instructor arrives 30 minutes prior to start time and luckily the room is empty so there is time to set-up a laptop and iPad to access the multiple audio/video inputs and outputs. The technology TA, whose purpose is to provide real-time support to assist with technology issues so the instructor can focus on the student learning experience (Pelletier et al., 2021), also arrives early and sets up a laptop to connect with the online group and help with managing the audio/video in the room. The online students seem to be having connectivity issues and continue to freeze on the screens and lose audio access. As a result, the online students ask the instructor to continually repeat instructions.
2. Instructor tries to teach both groups at the same time in a typical room and has a laptop or computer in the room set on Zoom. The students on Zoom ask questions, but the instructor does not see the students on Zoom and is focused on the students in the classroom. Someone in the back asks a question which the online students do not hear, and they are confused by the response provided by the instructor. There is noise in the room, so the online students are not hearing what the instructor is saying. The instructor provides activities for the students to move into small groups. Luckily, someone in each group has a laptop and they can add one of the online students to their group. The online students can barely hear what is happening with all the background noise in the room. The group tries to find another location to work in.

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3. Instructor teaches on-campus students live in a typical or technology-enhanced room and makes a recording for the online students and posts the recording for them in the LMS. The recording has so much background noise that online students are not satisfied with the recording and feel they are missing out on the class activities/group work that occurred during the class. The online students can ask questions by sending an email to the instructor or posting a question in the LMS.
4. Instructor teaches the lecture to on-campus students live in a typical room and then repeats the lecture for the online students at a different time from their office or other location. The instructor plans for and teaches two times. On one of the scheduled seminar dates, the instructor is unable to make it to class so asks all students to meet online. The on-campus students have difficulties finding quiet spaces on campus where they can now access the class online.
5. Instructor records their lecture and makes it accessible to all students in the LMS. The instructor then plans some activities for the on-campus students to complete during the scheduled time and plans different activities for the online students to complete asynchronously and online. The students complain that on-campus or online group is receiving more feedback and preferential treatment. The instructor sends an anonymous class survey to all students to receive feedback on what can be done to address concerns of inequity.
6. Three instructors are teaching multiple sections of the same course in the teaching term. Sections are offered both on-campus and online, with some scheduled at the same time. The three instructors design a team-teaching approach where on-campus sections are live-streamed for online students and uploaded to the course LMS for asynchronous viewing. During the livestream, one instructor provides instruction with a second instructor managing the online group. Instructors co-plan and design all learning tasks and assessments, which results in variations in tasks for those in-person and online, but also allows for group collaboration to be composed of both on-campus and online learners. As well, students can join virtually or on-campus to any session, providing them additional flexibility in their schedule.

Related Literature:

Irvine, V. (2020). The landscape of merging modalities. *EDUCAUSE REVIEW*, 4, 40-58.

<https://er.educause.edu/articles/2020/10/the-landscape-of-merging-modalities>

Lightner, C. A., Lightner-Laws, C. A. (2016). A blended model: simultaneously teaching a quantitative course traditionally, online, and remotely. *Interactive Learning Environments*, 24(1), 224–238.

<https://doi.org/10.1080/10494820.2013.841262>

Malczyk, B. R. (2018). Multimodal instruction, the new hybrid: A student-centered approach to blended learning. *Journal of Nonprofit Education and Leadership*, 8(1), 16–31.

<https://doi.org/10.18666/JNEL-2018-V8-I1-8347>

Course Delivery Approach #2: On-campus and Online Schedule (Blended)

In this design, class is scheduled to include a blend of components of online coursework as well as face-to-face classes. Online classes can be delivered either synchronously or asynchronously. Configurations might include the following:

- Weekly schedule of 2 days on-campus and three days off-campus/online.
- Daily schedule where students are face-to-face in the morning and off-campus/online in the afternoon.
- Two weeks of face-to-face lectures or seminars followed/combined with an assignment to be completed at a distance for two weeks. This configuration is referred to as *blended* in the Werklund School of Education, Graduate Program Professional Programs.

Benefits:

- Students learn beyond the classroom and are provided with possibilities to grow within the community
- Development of a multifaceted connection to education as bond with instructor is both electronic and face-to-face
- Provides flexibility for learners and increased access to learning, thus attracting students from a wider range of locations.

The Challenges:

- Amount of time spent constructing high-quality online lectures, presentations, and learning tasks
- Time required to prepare or organize off-campus opportunities
- Reliability of technology
- Students may find it challenging to locate spaces for online work when they are on-campus for other classes
- Students may ask for alternatives when unable to attend on-campus

Potential Scenarios:

1. Instructor has been assigned two sections of the same course. Section A meets on-campus on Mon/Tues with an off-campus component Thurs/Fri. Section B is scheduled off-campus Mon/Tues and meets on-campus Thurs/Fri. Because the schedule is mirrored, a previously routine full-day experience must be scheduled shorter in length and on two separate days.
2. After attending their morning on-campus course component, a student cohort disperses to situate themselves to reconvene for their online afternoon courses. However, a power failure in one quadrant of the city prevents some students from joining. The instructor records the class and uploads it to the LMS for students to access once power is restored. However, an extension will be required for those who were unable to complete the task during the assigned time.
3. As part of online coursework, the instructor sets up individual blogs for students and assigns a reading response as the first entry. A video tutorial of how to activate accounts has been

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uploaded to the LMS. However, the platform upgraded, and log-in procedures have changed. A new video must be made or time from class will be needed to review the new log-in steps.

4. After a two-week condensed time on campus, students depart to complete their final group assignment at a distance. The instructor begins to receive email expressing concerns over difficulty in groups as students live in different time zones with varying commitments. The instructor posts in the online LMS a reminder of course expectations and offers virtual office hours to assist students in setting up a group schedule.
5. Students who are taking multiple classes during a term raise concern over disparities between the online synchronous sessions offered in two of the classes. The online sessions are scheduled at a different time from what was communicated in the calendar/schedule or website. However, students planned their schedules based on the calendar and now have conflicts with other commitments and the new times.

Course Delivery Approach #3: Enriched Virtual Learning

In this model, the majority of coursework is completed online with learners required on campus for some face-to-face interaction, such as lectures, seminars, labs, etc. Online coursework can be both synchronous and asynchronous.

Benefits:

- Provides the flexibility of online learning with some in-class instruction
- Data analytics from online grading software can provide instant feedback to students
- Does not require daily school attendance

The Challenges:

- Amount of time spent constructing high-quality asynchronous lectures and presentations
- Reliability of technology
- Students may not have the opportunity to attend labs

Potential Scenarios:

1. Instructor designs for a weekly synchronous class 90 minutes in length, alternating between online and face-to-face delivery as well as a weekly asynchronous task to be submitted through an LMS. While online discussion and participation is high, on-campus sessions are difficult to engage students in conversation and collaborative activities. The instructor notices classroom participation online has not transferred to on-campus classes. To help foster participation, a backchannel chat forum is created and projected on the classroom screen. Students can share their thoughts or answers to questions, which the instructor uses to encourage a classroom dialogue.
2. Instructor records a lecture and makes it accessible to all students in the LMS. Students are asked to post any questions related to the lecture in the LMS discussion board. The instructor then plans some activities for an on-campus seminar building from the recorded lecture. No questions are posted on the discussion board, but when the face-to-face activities are enacted, the instructor quickly notices significant learning gaps which are preventing students from completing activities. The instructor pauses activities to clarify misunderstandings. Not all tasks planned for the face-to-face seminar are completed. These remaining tasks are modified to be completed asynchronously.
3. Students are required to complete an oral examination. An assessment rubric has been uploaded to the LMS content section. Using synchronous technologies, a component of online seminars is planned for assigning students to breakout rooms where they engage in peer feedback loops using the rubric provided, practicing their oral presentations. The instructor visits breakout rooms to provide feedback as well. Students then sign up for a 20-minute time slot during face-to-face class times to present to their instructor.
4. Two instructors are teaching one section of a same course offering in the same teaching term. Sections are offered online with a monthly on-campus block. The on-campus block is at different times for the instructors. The two instructors design, record, and curate online content together,

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uploading to their corresponding course LMS. In addition, each instructor uploads a weekly audio or video synopsis providing suggestions for work completion and answering any student questions that arise. On-campus blocks are designed as small group tutorials and assessments.

Related Literature:

Edgenuity (2013). Online learning platform getting results at New Mexico enriched virtual school: Edgenuity delivering core curricular content at Rio Rancho Cyber Academy. *District Administration*, 49(5), 11.

Course Delivery Approach #4: Rotational

The rotational model of blended learning consists of three variations: station, lab and individual. Students learn on-campus in a fixed schedule alternating between online and face-to-face tasks in one or multiple learning spaces. The lab rotational model is distinguished by using a lab space with a second instructor or TA, allowing for more classroom space, and increasing instructor availability to work with students. The individual rotation approach intends for students to rotate on an individual and customized schedule.

The Benefits:

- Provides variety in learning approaches
- Fosters collaborative learning
- Students are able to work at their time and pace
- Provides opportunities to engage in formative assessment

The Challenges:

- Need to arrive early to set-up and have time following class to shut down
- Multiple lesson types are required for one class
- Reliability of technology
- Set-up (physical and online) can take extra time

Potential Scenarios:

1. In preparation for a 90-minute class, the instructor sets up five stations that are intended to take 15 minutes each. This allows time to set up the classroom, provide directions, run rotations, and bring the group back for final remarks. All tasks must be completed before the end of class. If some require more time, stations that can be completed outside of the classroom are identified. Station one includes logging on to the class LMS system and watching a pre-recorded lecture where students must take their own notes. Station two includes a partner activity that requires students to apply knowledge and skills from the pre-recorded lecture. In station three, which can be completed outside of class time, if necessary, students complete an online lab simulation. At station four, a reading connected to the class topic is provided for students. Station five, an activity that can be completed outside of class, requires students to write a one-paragraph response, supported with facts/evidence from the four other stations, illustrating understanding of the topic explored. Students rotate between the five stations at their own pace, beginning at one of two designated stations (one or four).
2. Instructor organizes students into three groups for a 90-minute class. The first group works with the instructor where new content is introduced, prior concepts are revisited, or learning is extended for those who demonstrated sufficient understanding. The second group works either independently or as a collaborative group on assigned work. The final group participates in digital curriculum that aligns with concepts being explored in class, including a virtual simulation, quiz, watching a video, math practice questions, and 3-dimensional design. Students

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rotate through all three stations daily and can move to a different location outside the classroom when working on the independent or collaborative group section.

3. Instructor organized students into four groups requiring use of technology. However, the power supply for the classroom was not working. The instructor provided an alternative no-tech task while arrangements were made to access tech support.

Related Literature:

Yang, S., & Newman, R. (2019). Rotational blended learning in computer system engineering courses. *IEEE Transactions on Education*, 62(4), 264–269. <https://doi.org/10.1109/TE.2019.2899095>

Course Delivery Approach #5: Flipped

Flipped learning is a pedagogical approach where a lecture is often delivered asynchronously and commonly occurs through audio and video recordings prior to synchronous sessions (on-campus or online).

The Benefits:

- Flexible access to asynchronous components
- Opportunities for experiential and participatory learning during synchronous sessions
- Opportunities for one-on-one interactions
- Opportunities to engage in formative assessment

The Challenges:

- Time and skill to create instructional videos, podcasts, content for asynchronous components and active learning for synchronous components
- The time commitment required for students for asynchronous components
- Students could have questions during asynchronous components

Potential Scenarios:

1. Prior to class, students are invited to view a 10-minute video and complete an “entrance ticket.” The video contains information students will be required to apply to the in-class activity. However, while students were informed in advance about the videos and provided access through the LMS system, some students came unprepared.
2. Instructor makes a video recording for students and posts the recording for them in the LMS. The recording, when viewed in full screen, has low resolution so students cannot fully understand/view the content. When students arrive in class, the instructor is asked to go through the content again and students have many questions. There is insufficient time to engage in the learning activities that were planned for the synchronous component.
3. Instructor is teaching a flipped course for a second iteration and plans to re-use video recordings from a previous course offering. However, some videos contain screen recordings where student Zooms cameras are shown. The instructor needs to edit the video to anonymize the content prior to posting in the course LMS.
4. Instructor assigns a video response assignment and schedules two synchronous sessions for the assignment. The instructor creates a video that summarizes the steps required to make a video, learning intentions and criteria that will be used for assessment. The video is uploaded to the course LMS. The instructor recommends students watch the video prior to the next class.
5. Instructor creates self-assessment activities and uploads them to the course LMS. Learners complete these prior to and/or after a lesson to self-assess their understanding of a topic. The self-assessments are accessible on mobile devices and can be completed in less than 10 minutes. The instructor can project results anonymously for class discussion.

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Related Literature:

Long, T., Cummins, J., & Waugh, M. (2017). Use of the flipped classroom instructional model in higher education: Instructors' perspectives. *Journal of Computing in Higher Education*, 29(2), 179–200.

<https://doi.org/10.1007/s12528-016-9119-8>

Sahin, A., Cavlazoglu, B., & Zeytuncu, Y. E. (2015). Flipping a college calculus course: A case study. *Educational Technology & Society*, 18(3), 142–152.

Course Delivery Approach #6: Mastery-Based Learning

Students rotate between online and face-to-face learning activities and progress through course learning objectives only once mastery has been demonstrated.

The Benefits:

- Self-pacing
- Mastery of content
- Possibilities for more personalized interaction and supports from instructor and TA

The Challenges:

- Traditional assessment practices/tools may need to be modified
- Students' ability to move at their own pace may be restricted by term completion dates

Potential Scenarios:

1. Designing the course for self-paced mastery, the instructor creates short instructional videos, which allow students to move at their own pace. For each concept, students watch a video online or in-class and then practice the concept through a game, activity, or online tool. One TA has been assigned to this class to support students. When a student feels ready, a mastery check is conducted with the instructor or TA to determine if the student can proceed to the next topic. All assessments are completed one-on-one with the instructor or TA. A pacing calendar is provided to the class to help students understand anticipated progression to complete the class by the end of the term and receive credit.
2. Working in a hybrid model, the instructor meets with students two days on campus and with two days delivered online. The instructor organizes learning objectives so certain ones are completed only online. The instructor relies on online quizzes to assess progression, but fears students may be cheating when completing quizzes online. A new assessment format is designed where students are required to video record their thinking; students must record themselves completing the task and talk through the steps they are applying out loud.

Related Literature:

Bates, A. W. (2019). *Teaching in a Digital Age* (2nd ed.). BCcampus.

<https://open.umn.edu/opentextbooks/textbooks/221>

Pamungkas, M. T. & Basori, M., & Maryono, D. (2020). The effect of mastery-based blended learning on the independence and creativity of students. *Advances in Social Science, Education and Humanities Research*, 440, 58-62.

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