Learning Software Engineering - Online

Kalman C Toth

kalmanctoth @gmail.com

ABSTRACT

It is apparent that software practitioners seeking advanced education and professional development demand programs that blend with their obligations at work and at home as well as yield immediate benefits. Ideally, software engineers should be able to integrate their learning with how they work. Acculturated by their social and business networks, they would prefer to use tools and interfaces that are similar to what they already use. The learning processes and tools they are expected to use when learning should blend with their day-to-day processes to the extent possible.

Offering classroom courses in the edge hours - evenings and weekends - is an approach that meets the needs of many working software professionals seeking advanced education. However, the time such practitioners can devote to the campus commute to attend a few hours of classes is rapidly shrinking. Learning by way of online methods and tools has therefore become increasingly popular over the last several years. E-learning over the web offers a great deal of flexibility over traditional learning modes. Several variants and hybrids of these models can, and have been, implemented, each offering distinct benefits, but also limitations.

My experiences to date suggest that better, more cost-effective, and more relevant learning can be achieved by hybridizing face-to-face and online learning modes. For example, hybrid learning can increase the depth of engagement through discussion forums, provide access for dispersed learners, and also satisfy the demand for a modicum of face-time for those students who are prepared to attend classes on campus. However, "one size does not appear to fit all" – for example, discussion forums appear to be less effective for programming courses, while demonstration videos walking through coding and testing samples seem to be very effective. And online teleconferencing mechanisms supporting shared visual space and jointly authored documents are very effective for work group activities – much like those experienced on-the-job.

This paper describes my experiences and evolution of various learning models and hybrids that I have leveraged to blend certain critical elements of traditional face-to-face and online learning approaches. A spin-off benefit of e-learning is that classrooms are freed up for other purposes, reducing the demand for costly physical facilities. In this paper I explore several blended learning model variants that I have used to teach software engineering courses. The observed benefits and limitations of these learning models and support tools are highlighted; and several outstanding questions and issues for further consideration are raised.

BIOGRAPHY

Kal Toth holds a Ph.D. from Carleton University, Ottawa, Canada and is a registered professional engineer in British Columbia with a software engineering designation. He has worked for a range of companies and universities including Hughes Aircraft, CGI Group, Intellitech, Datalink Systems Corp., Portland State University, Oregon State University, and the Technical University of British Columbia. His areas of specialization and R&D interest include software engineering, project management, information security, and identify management.

1. INTRODUCTION

Portland State's Oregon Master of Software Engineering (OMSE) program has offered a 16-course masters degree to software professionals in Metro Portland (Oregon) since 1998. In 2008, OMSE began to offer a 5-course graduate certificate in software engineering. Courses are also offered on a professional development basis. Over a period of several years, OMSE introduced e-learning and hybrid course offerings to satisfy the growing demand for more learning flexibility. During the development and evolution of these offerings, several variants of these learning models have emerged.

With the proliferation of the web and e-collaboration tools, the distinctions between various learning models have been narrowing. A traditional learning model achieves learning almost entirely through face-to-face sessions in the classroom (lectures and Q&A sessions). An online (only) learning model achieves most if not all learning through online web-based mechanisms. Various "blends" or hybrids of face-to-face and online learning can be designed.

Hybrid learning models combine traditional face-to-face and e-learning mechanisms in various ways. They will generally include some traditional face-to-face instruction in a classroom setting and deliver a substantial portion of the learning content as well as engagement with the instructor(s) and other students by means of Internet-enabled collaboration mechanisms.

Another dimension of hybrid learning has to do with the collaboration processes and tools used, namely, whether instructors and learners communicate asynchronously ("time-shifted") and/or synchronously ("at the same time"). Asynchronous collaboration is achieved through email, discussion forums and other non-concurrent communications mechanisms, while synchronous collaboration is achieved through real-time chat, teleconferencing (audio / video) and similar technologies.

2. TRADITIONAL CLASSROOM APPROACH

When OMSE was first launched, each course was composed of 3-hour classes one day per week in the evenings over a 10-week period (plus an eleventh "exam week"). Lectures were presented via a data projector; and Internet access made it possible to discuss web content. Course materials were initially distributed in binders and updated as required. Attendance in the classroom was expected and grades were awarded for both class participation and the quality of assignments and take-home exams. Student work was submitted by email for the most part.

Soon, learning materials were made available through a password-controlled web site which significantly enhanced access to learning materials and facilitated updates by the instructor throughout the term. However, access control, updating, version control, and backup were conducted in a fairly ad hoc manner leading to possible inconsistencies and the risk of occasional unavailability of learning materials.

Being working professionals, OMSE students required a workable solution when on travel status, as well as on those occasions when sick or otherwise pulled away from class for personal reasons. We therefore began to record classes onto video tape using a fixed camera and a podium microphone, making the tape recordings available for later viewing. This was a reasonable solution at the time. However, with the fixed camera aimed at the lecture materials projected on the screen, the audio/video production quality was fairly low quality and rather "amateurish" looking. And the logistics of recording, borrowing and returning tapes was an inconvenience for instructors, students, and the Program Office.

3. OUR INITIAL EXPERIENCE WITH ONLINE LEARNING

Open University [1] in the United Kingdom was the first university successfully delivering distance education by means of communications technology. E-learning, also commonly referred to as online learning, emerged out of numerous efforts over the 1970 to 1995 period. Bates [2] comprehensively describes the range of possible technologies for distance education including cost structures, teaching

applications, organizational issues, and course development implications. At about this time the potential of the Internet for e-learning began to become a reality and new online collaboration technologies and pedagogies began to proliferate. The pros and cons of synchronous and asynchronous e-learning are discussed extensively in the literature by authors such as Hrastinski [8].

Learning Management Systems like WebCT [3], Blackboard [4], and eCollege [5] became available in the 1995 to 2000 timeframe. Most of these efforts did not favor synchronous e-learning collaboration using teleconferencing technologies – they were arguably too limited in performance and/or too expensive to deploy and scale for university and college learning applications. Instead, these learning management systems emphasized asynchronous e-learning (a.k.a. Asynchronous Learning Networks (ALN)) that leveraged the web by way of online discussion boards/forums and email. These systems also incorporated repositories for maintaining and dispensing learning materials and related resources to students on demand.

The arguments favoring the ALN have been well articulated by the Sloan Foundation [7] and others. Asynchronous discussions stimulate critical thinking, reflection, and thoughtful (written) expression which enable students to engage more deeply with instructors and other students than in traditional classroom learning. In the case of OMSE, because all of the students are software professionals, asynchronous discussions provide an opportunity for them to learn a lot from each other as well as from the instructor – an additional value-add. OMSE's first foray into online learning considered the following benefits of asynchronous learning:

- Students do not need to come to campus and meet at preset times;
- They can participate online at virtually any time and from any place;
- The flexible learning style allows them to read and think before expressing their thoughts;
- Students reflect more deeply on the many complex issues of the subject matter;
- Students whose primary language is not English can more easily keep pace with the class.

Counter-arguments included:

- Social Aspects such as the potential of increased isolation of students and instructors from each other;
- Barriers to getting acquainted and planning out learning tasks;
- Reduced effectiveness of motivational queues derived from facial expression and body language;
- Issues of academic integrity compromise do to the challenge of authenticating student work (assignments and exams).

Most of these issues have been countered in the literature. For example, Wegerif in [9] espouses the social dimension of asynchronous learning and makes constructive recommendations arguing that appropriate planning and instructor facilitation will build strong communities of learners and effective learning. Building a measure of residency requirement into a program can mitigate the student authentication risk.

Early in the OMSE program we had not anticipated the possibility of putting the entire program online. When the subject came up we wondered whether and how online models would satisfy issues of faculty engagement, belonging, and honesty. With respect to engagement we began to recognize some of the benefits of e-learning, and we began to better appreciate that traditional courses also ran similar risks of student comradeship and academic integrity. Given that our students are working professionals and often work in distributed and ever-changing teams – we argued that such risks were manageable. We concluded that the pros outweighed the cons for our target audience.

In 2000, the OMSE Program Office began to invest in the necessary planning and preparation effort to offer a few courses online. In 2002 and 2003 we converted and offered three of our software engineering courses via the eCollege learning management system thereby increasing learning flexibility and options for students. This initial experience with e-learning set in motion OMSE's gradual evolution of flexible and innovative online and hybrid learning models. Feedback from students and instructors was positive.

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However, a commitment to make additional OMSE courses available online was delayed by a few years due to lack of buy-in and lack of sufficient resources. Over time we partially overcome these barriers.

4. CAPTURING AND STREAMING LECTURES AND Q&A SESSIONS

In 2003, OMSE courses began to be offered in PSU's Distance Learning Center (DLC). The primary objective of this transition was to replace video tape recording with web-based streaming.

The distance learning center classrooms contained 3 cameras, push-to-activate microphones, a data projector, a PC, Internet access, a document display device ("Elmo"), and various controls and monitors. Student assistants in a neighboring control room managed the cameras and sound; the instructor controlled the presentation sources; and the students controlled their microphones. This enabled the recording of lectures which where digitized and made available via streaming to students who were unable to attend the face-to-face sessions.

This was a significant improvement over the video tape-recording system for three reasons: it eliminated much of the logistical problem of tapes; the video of the instructor and projected materials were more dynamically captured; and student participation in the classroom was made available via the data stream over the web. However, the quality of lecture slides was rather low - degraded by the digitizing and streaming processes - obliging instructors to use larger fonts than they would have otherwise. And the audio from the student participants was inconsistent because of the need to "push to talk".

Unexpected Benefit: An unintended capability that materialized was that the streamed classes were often, but not always, available 5-10 seconds after being captured. This allowed students who were unable to come to the classroom, but otherwise available, to remotely access and view the a/v streams. Students with other obligations at home, at work, or on travel status could thereby keep pace with the course in close to real time. These streams could also be accessed days later, or whenever students might want to review specific course content.

5. LEARNING MANAGEMENT SYSTEM

In 2004, PSU was routinely supporting WebCT [3], a popular learning management system. This LMS, which was similar to eCollege in several respects, was supported by PSU's IT infrastructure. Between 2004 and 2006, we "resurrected" our initial OMSE online courses by migrating them from eCollege to WebCT. We began to offer these courses online, as well as in the traditional face-to-face learning mode, leveraging WebCT's support for asynchronous discussion forums and assignment submissions.

Guidelines for conducting and pacing online discussions were provided to students and adopted by OMSE instructors. During "discussion weeks" the instructor posts one or two questions. The students are required to first post a well thought-out response to each question by mid-week, and then rebut the primary posts of at least two other students by the end of the week. The instructor comments on every primary post and selected rebuttals first; and then provides a single substantive feedback post to all of the students at or very soon after the close of the week.

WebCT's comprehensive assignment support capabilities were also used for posting, downloading, uploading, tracking, submitting, grading and feedback purposes.

In 2008 WebCT was replaced by Blackboard CE 6 [4]. Conversion of courses from WebCT to Blackboard was not painless. Conversion was successfully achieved by way of the devoted efforts of the instructors. In 2010-11, PSU replaced Blackboard with Desire2Learn [6] and a similar conversion effort was required. In summary, online OMSE courses progressively exploited the following learning management capabilities:

1. Access to course resources including syllabus, lecture slides, articles, and relevant web links;

2. Weekly lesson plans pointing to assigned resources, activities, discussions and assignments;
3. Discussion forums supporting asynchronous collaboration among students and instructors;
4. Weekly assignments, take home exams and quizzes with submission guidance;
5. Grading ("Gradebook") support allowing instructors to record, track, and process grades;
6. "My Grades" – students are able to view their grades from week-to-week;
7. Announcements – instructor messages to all students that pop up when they log on;
8. Email – students are able to capture all student and instructor emails related to the course;
9. Student Lists – enrollment status;
10. Student Usage Tracking – # of accesses to assignments, discussions and other elements.

6. PRE-RECORDED AND NARRATED MINI-LECTURES

When OMSE was resurrected in the 2004-2006 timeframe, we acknowledged the above-mentioned criticisms of asynchronous learning, in particular, that students may tend to feel isolated from the instructor and each other. We attempted to partially overcome this problem by posting:

a) Pre-recorded mini-lectures or
b) Narrated PowerPoint mini-lecture presentations.

Mini-lectures are meant to highlight the most important points, pace the course, and tell the students where to look for the details (e.g. in textbook, articles, etc.). The strategy we adopted depended on the following assumptions:

- That weekly full-lecture (3-hour) presentation slides are available
- That the instructor is very familiar with these slides, and
- That the instructor has already created 20-30 minute mini-lectures (10-15 slides each) from them.

Our experience is that:

i) Pre-recorded mini-lectures require the instructor to invest an estimated 1.5 to 2 hours per mini-lecture in the studio presenting the mini-lecture slides in front of a camera.
i) Narrated PowerPoint mini-lectures require about the same investment in the instructor's time but do not require the use of a studio and camera-person.
ii) Narrated lectures are easier to update. One can add, delete and re-narrate individual PowerPoint slides without re-recording the entire mini-lecture. This is impractical with studio-recorded mini-lectures, or at least considerably more challenging and costly;
iii) Narrated mini-lectures can become rather large and impractical for students to download. One must keep the narration crisp; avoid silences and pauses; and use appropriate recording settings to keep volume of digitized narration from becoming too large.
iv) Studio-recorded mini-lectures can ramble on more in an attempt to squeeze in more content, however, the idea is to be brief and to the point.

We have had mixed feedback about the benefits of such mini-lectures. Additional study is required in this aspect of our approach. We continue to be hopeful that this type of learning element will be useful if augmented by other elements that help engage the students and the instructor.

7. LEARNING SYSTEMS SUPPORT F2F

Prior to the availability of WebCT and Blackboard, OMSE courses maintained course content on a password-controlled web site. Instructors were responsible for maintaining / updating these materials. With the introduction of commercial learning management systems it became possible to maintain learning materials in a structured course container which provided a common organization with stronger, more flexible, and centrally administered access controls, maintenance, and a help desk.

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Although WebCT and Blackboard were somewhat "clunky" in comparison to commercial tools, they are relatively intuitive and easy to use. This was definitely a significant step in the right direction. This greatly enhanced instructor productivity with respect to syllabus, lecture and assignment preparation; grading, class coordination, and student usage tracking; and the setup and engagement in online discussions. Progressively, our instructors learned how to exploit these useful functions and features.

I observed that it would be a relatively small step for an LMS-enabled traditional face-to-face course to add a few online discussion forum assignments and thereby partially resemble an online course. The distinction between traditional and online learning modes was becoming increasingly blurry.

8. OUR INITIAL EXPERIMENT WITH HYBRID LEARNING

In 2007 we began to consider the possibility of blending face-to-face and e-learning delivery modes. Although certain of our students preferred face-to-face sessions over online courses, we reasoned that their busy schedules would make online collaboration an attractive alternative when students are unable to come to campus. And we knew from experience that many students are sometimes unable to attend for various logistical and personal reasons. So we asked ourselves, why not let the students mix and match elements of face-to-face and online delivery modes? Wouldn't this potentially maximize the distinct benefits and provide more flexibility for our students?

We began by offering our professional communications course to a number of students who participated strictly in online mode - never coming to class. They received delayed streams of the face-to-face sessions attended by the other students in the class and participated in the same asynchronous discussion forums as the face-to-face students. Although not present in the classroom, they were an integral part of the collaborative learning process, receiving feedback and grades just like everyone else. This initial offering really tested what could be effectively learned through the combination of asynchronous e-learning and streaming media.

This first hybrid delivery-mode course opened our eyes to the possibilities and benefits of offering combined hybrid face-to-face and e-learning courses. We soon realized that software professionals are already accustomed to working with each other online. For them, sharing information via email, instant messaging, VOIP (e.g. Skype), bug-trackers, version control systems, document sharing tools, and collaborative web pages (wikis) is routine. The jump to online e-learning is a small hop for them and quite natural. But most professionals also want to get some of the learning from the "horse's mouth" -- an instructor they can interact with in the classroom.

Our observations validated our hybrid vision for learning, that is, one where we simultaneously deliver learning face-to-face and also collaborate over the web. We reasoned that this would achieve superior results by combining the two approaches (Milhauser and Toth [10]). Such a flexible approach to learning certainly provides distinct advantages for the student - they can decide whether they would rather take the course face-to-face, or online, or in some combination. For students unable to come to campus, the online delivery mode remains a viable option.

9. UPGRADING STREAMING QUALITY

In 2009, a product called "Echo 360" was introduced to upgrade the quality of delivered streams. This tool captures and mixes the audio-video feed from the remotely controlled cameras in the classroom with the data presentation, document camera, and Internet browsing sources. The technology broadcasts this instructional material to learners, just-in-time or delayed, through a highly flexible and media-rich user-controlled interface. These streams are made available through links automatically embedded into the learning management system. The quality of the presented course materials and a/v streams was significantly improved by this transition to Echo 360.

10. THE INTRODUCTION OF SYNCHRONOUS COLLABORATION

Bates [2] and other authors have long espoused the use of teleconferencing tools for synchronous online learning. Such tools had the potential of increasing social, interpersonal, motivational, and organizational aspects of the online learning experience. And such synchronous capability complements the proven benefits of asynchronous engagement and learning. Chou [11] illustrates the benefits of synchronous learning integrated with traditional ALN systems and makes useful recommendations that leverage "student-moderated" synchronous sessions. As already mentioned, the high costs of these tools put them out of reach for universities and colleges in the early years of e-learning.

However, great advances have been made more recently. Internet bandwidth has increased in leaps and bounds at very affordable levels for both universities and students. And a plethora of comprehensive webinar and teleconferencing tools have become available. Of particular interest is the paper by Latchman et. al. [12] that presents a comprehensive framework for such synchronous mechanisms that have been apparently borrowed and adapted by many of these products.

In the fall of 2009, PSU acquired licenses for a high quality synchronous collaboration tool called "Elluminate" [13] which supports both webinars and teleconferences. Elluminate's long list of functions and features include session scheduling and notices, audio conferencing, shared visual space, text messaging, webcam support, and session recording. We found the tool to be acceptably reliable and scalable.

During 2009-2010, we began to phase in this tool to support synchronous team meetings for our practicum course, several synchronous Q & A sessions for our software estimating course, and a couple of webinars.

11. THE HYBRID LEARNING PROCESS

Under our hybrid learning approach, attendance at face-to-face sessions is optional. Some students will attend most of these F2F sessions; some will never attend (online-only); and still others will choose to attend occasionally.

All students make use of a common pool of learning resources (textbook(s), articles, papers, hyperlinks to electronic documents, etc.). These resources are made available through our learning management system (LMS). Through a weekly lesson plan posted in the LMS, learning is synchronized for both face-to-face and online learners. Student activities are guided through a checklist that may include mini-lectures highlighting key points, posted full-up lecture materials, textbook and other assigned readings, and posted take-home assignments. Discussion forums are extensively used to asynchronously engage all students and instructors in thoughtful exchanges of ideas and exploration of assigned problems.

The cadence of student learning through assignments, discussions, and project work is synchronized across the face-to-face and online dimensions of a course. One approach we have used is to hold an initial discussion in the classroom (which is streamed), summarize the results, and then post them online to seed a more in-depth discussion during the week. For example, students in the face-to-face class on a Tuesday night might conduct a discussion of the benefits and challenges of software quality and code reviews; and then explore this issue further in the online learning space with an asynchronous discussion thread created and facilitated by the instructor. Conversely, an asynchronous online discussion might be held first, with a summary discussion in the classroom.

Regardless of the exact process or timing, the instructor must ensure that students attending classroom sessions, and those participating online, are active participants of the larger integrated discussion.

12.   LEVELING THE PLAYING FIELD

To achieve assessment equity across a hybrid model, grading of assignments, discussions, participation, and project work need to be balanced and fair - whether the student is face-to-face, online, or both. Because learning is accomplished differently, achieving such balance requires the careful attention of the instructor.

In the classroom setting, students traditionally get "participation points" for showing up in a classroom and the instructor tries to get a measure of the quality and degree of participation of all students in the class. The more extraverted students stand out and often make substantial contributions to the class. But some student contributions are more "noise" than substance and in some cases may actually be disruptive to the class. Meanwhile, introverted students or those less proficiency in English will be less visible or not visible at all. It is clearly not practical for the instructor to count the number of times a given student speaks out, or measure the quality of each contribution fragment of the student. Because of these limitations, most instructors tend to allocate a small proportion of the total grade for in-class participation and use a rather subjective and low granularity assessment scale (e.g. poor, fair, good, excellent) of student participation.

In an online class, meanwhile, introverted students can shine. Those with trouble in English can take extra time to express themselves, and the more extraverted students, especially the "noisy" ones, are obliged to express themselves more clearly and thoughtfully than they would in a face-to-face setting. The main advantage of online versus face-to-face discussion is that the instructor can actually assess the participation level first, and then examine the true quality of written student postings. The advantage is that the quality of online participation can be assessed with more assurance and evidence than the quality of participation in classroom sessions. This allows a larger proportion of grades to be allocated for online participation.

A critical factor to achieve balance is to ensure that both face-to-face and online students participate at the same level in online discussions. It is important to distinguish between the participation level in online discussions and the quality of these discussions. In-class participation grades should be eliminated altogether when conducting such hybrid delivery-mode courses.

13.   TEAM PROJECTS

Whether accomplished through face-to-face or e-learning mechanisms, team projects are always a challenge. Projects run in a classroom setting generally have the students meeting in classroom time slots, sometimes with the instructor present judging team participation. Of course, team presentations are a key component of assessment. Elluminate has proven to be very effective for supporting synchronous online sessions among students working in teams, including project team presentations [14].

Assessing team participation among members of a distributed project team is a bigger challenge. Often teams will work on their own using their collaborative tools of choice. Some may use simple email with scheduled status updates provided to the instructor. Others will use free tools like Google Docs and Yahoo Groups. At PSU we have had good success with both PSU Online (WebCT and Blackboard) and Wiki collaboration tools. They each have their advantages - but also their weaknesses. The instructor becomes a member of every team to provide oversight and guidance, and can monitor the quality of team collaboration. Online tools thereby facilitate project team assessment.

14.   LEARNING ASSESSMENT AND CONSISTENCY

At this stage I wondered how we could level the playing field between face-to-face and online (only) learners - those who did not attend many if any of the face-to-face sessions. We found no easy answers. One level-setting practice that I have used successfully is to create assignments that require students to summarize their learning (whether online or face-to-face) at key points in the class. Another is to conduct peer assessments where all team members submit the evaluations of how well each of their teammates

contributed toward their shared goals. Again, the same assessment method is used whether the class is face-to-face or online.

A key to success is to ensure that instructors are comfortable with the level of engagement, whether the student is online or face-to-face, and that expectations of students are spelled out clearly and reinforced repeatedly throughout the course.

15. ENGAGEMENT AMONG FACULTY AND LEARNERS

In addition to learning extracted from course content and resources, students learn from the instructor as well as from each other. This is particularly true of courses offered to experienced practitioners such as those in the OMSE program. An important goal of ours has been to engage students and instructors via our blended (hybrid) delivery-mode and e-learning formats. The following scenarios represent approaches we have used to engage face-to-face and online learners with the instructor and each other:

a) Studio-recorded lectures or lectures narrated by the instructor in advance. They are accessed through the learning managing system by downloading them or by streaming.
b) Questions posted by the instructor to stimulate online discussions related to the week's subject matter conducted asynchronously within a defined time interval.
c) Weekly Q & A sessions facilitated by the instructor and streamed to the online students. The instructor summarizes the results and challenges the class with related questions to be discussed online asynchronously.
d) Synchronous sessions run in lecture style (e.g. like webinars) or interactive Q&A sessions. By using tools like Elluminate, the need for face-to-face sessions can be significantly reduced or even eliminated.

16. FISCAL AND PHYSICAL IMPLICATIONS

I began to consider the cost and space implications of hybrid course offerings. By shifting more of our learning to asynchronous and synchronous e-learning collaboration mechanisms, there is a strong argument for reducing the number of face-to-face hours required to satisfy learning needs and student preferences.

Being working professionals, OMSE students are increasingly telecommuting and working in distributed teams – often dispersed regionally and even globally. They are using asynchronous and synchronous processes. For example, software practitioners already make extensive use of email, version control systems, problem tracking and resolutions systems, shared knowledge databases, and team blogs – all of which are asynchronous. And many are also beginning to leverage teleconferencing and webinar tools which are synchronous. The physical space they need to work synchronously with each other is rapidly shrinking.

Similarly, hybrid learning can reduce demand on classroom space by increasing the learning elements that are conducted online – both synchronously and asynchronously – thereby decreasing the amount of face time required. Our initial guess is that face-to-face time can be reduced 50% without impinging on the needs of those students expecting and/or demanding face-to-face learning. Delayed streaming and studio and narrated mini-lectures may be sufficient to satisfy students who are either more interested in online learning, or students who cannot attend. Recorded synchronous Q & A sessions and webinar-styled mini-lectures may also be very acceptable to a significant number of students. And of course, streams and recorded synchronous sessions will prove to be adequate for all students to cover absences from the classroom.

17. SUMMARY

Students who have taken hybrid courses have reported that because they can schedule their class time to dove-tail with their other day-to-day obligations, they are able to spend more time participating in online discussions and individual research – both of which increase the depth of learning. And it is common to receive reports of deeper engagement with classmates, instructors, and subject matter through online collaboration. At the same time students can elect to attend only targeted face-to-face classes to engage more closely with specific areas of interest and need. And the availability of streamed and recorded synchronous sessions will satisfy the social and motivational needs of many students.

From an institutional budget perspective, hybrid courses reduce the required classroom time thereby liberating the use of the space to other classes. This increases overall classroom space utilization and decreases operational costs for the university.

The net result is better total learning outcomes, improved retention, and flexible learning models that better integrate learning with work and home life – this is exactly what working professionals need and want. And better student retention is a critical success factor for the university as well as our program.

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