

Blended Learning to the Rescue: How one Construction Management Program is Mitigating the Risk of COVID-19 in the Classroom

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Blended Learning to the Rescue: How one Construction Management Program is Mitigating the Risk of COVID-19 in the Classroom

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Abstract

As universities struggle to contend with the COVID-19 pandemic, they find themselves having to balance many conflicting yet interconnected factors. While their priority centers on protecting the health and safety of students, faculty, and staff they must manage this health risk with the need to provide students with effective and productive learning environments. Additionally, there is added pressure to reopen classes for the economic benefit of their campus and of the wider community.

A key element to their success in managing these risks and trade-offs lies in their ability to reinvent their learning environments so that the online instruction facilitated by each institution's Learning Management Systems (Canvas, Brightspace, Blackboard, etc.) compliments student-teacher and other relationships⁷. One such approach involves the use of blended learning which combines the convenience of online instructional delivery with traditional in-person classroom instruction. Whereas the online content provides students with information in a manner that is flexible in time, place, and pace, the classroom element provides them with an opportunity to get instructor guidance, collaborate with peers, practice applying concepts, and exploring topics in greater detail. By blending the online and in-class learning elements of a course, the instructor decreases the risk of exposure to COVID-19 by shortening face-to-face instruction time.

This paper summarizes the results of a project in which blended learning was used for a sophomore level "Statics and Strengths of Materials" course with an enrollment of 40 students. By blending in-class learning with online learning, the instructor was able to minimize the risk of coronavirus exposure by splitting the students into two equal sized groups that met once a week rather than having all students meet for two weekly sessions. The use of smaller groups had the added benefit of facilitating the practice of social distancing. The outcomes of the study revealed several interesting results regarding student reactions to blended learning, the importance of active learning activities in keeping students engaged and motivated, and student perceptions related to the effectiveness of blended learning in protecting their health and wellbeing during the pandemic.

Keywords: Blended learning, COVID-19, risk, construction

Introduction

This section addresses the primary motivations for initiating the project and provides details regarding how blended learning was used within the course. The author also provides insight regarding several types of blended learning models, information as to how blended learning has evolved with technological advances in computing, and a perspective as to how blended learning can be used during this pandemic

Project Motivation

Like all academic institutions throughout the country, the School of Construction and Design at the University of Southern Mississippi finds itself in a difficult position of balancing the need to provide an effective learning environment for its students with the need to manage the COVID-19 related health risks for students, staff, and faculty. Having experimented with the use of face-to-face (in classrooms modified to comply with the Centers for Disease Control and Prevention guidelines) and synchronous/asynchronous forms of online instruction during the Fall 2020 semester, faculty within the School were open to using alternative instructional approaches for the Spring 2021 semester that could enhance student safety and learning.

One such approach involves the use of blended learning models which combines the attributes of online course delivery (flexibility with time and pace, efficiency) with the benefits of a classroom environment (opportunity to ask questions, get instructor guidance, explore topics in greater detail). Whereas the author had ample experience applying the blended learning model as a pedagogical tool for blending material best-suited for online presentation with content better-suited for a classroom setting, his rationale for using blended learning for this project was quite different: to provide students with classroom instruction while also minimizing their risk of exposure to COVID-19. Doing so required answering two fundamental questions:

1. What form of blended model would be most appropriate?
2. What is the best approach to limit students' exposure to COVID-19 in a classroom setting?

Addressing the first question required examining the three most common forms of blended learning models³:

Flipped Classroom Model:

The basis of the flipped-classroom approach is that students review lesson content away from class via online coursework and video-recorded lectures and then spend class time applying concepts and exploring topics in greater detail through teacher-guided practice or projects (see Figure 1 below). Whereas the online content addresses foundational learning at the bottom of Bloom's Taxonomy (such as knowledge and comprehension) the classroom sessions allow instructors to utilize activities (problem solving, discussions, projects) that deepen students' understanding, strengthen relationships, and make learning meaningful.

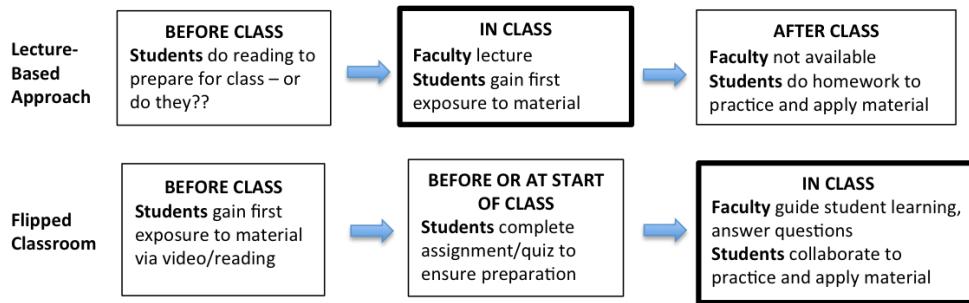


Figure 1. Comparison between a Traditional Lecture-Based Approach and a Flipped Classroom¹⁰

Enriched Virtual Model:

This model is an extension of the flipped classroom model with an emphasis on the online element. Under this model, students achieve most of their learning independently using materials that are designed for fully online courses with limited teacher involvement. As such, this model relies heavily on having course materials that are easily assessable and navigable for students with minimal teacher direction or facilitation. Rather than spending time on course content, teachers focus the limited time they have with students on addressing the specific challenges that hinder students’ independent learning such as misconceptions about content, counterproductive learning habits, and other learning challenges.

A La Carte Model:

This model applies to students who are enrolled in a traditional on campus degree program but want to supplement their campus classes with one or more classes online. Students normally enroll in a la carte courses when they require additional flexibility in their schedules or desire courses that are not available in a face-to-face setting.

In lieu of the attributes of the flipped classroom model (frequent interaction with students, flexibility with the presentation of online/in-class materials), the challenging nature of the course (not well suited for the enriched virtual model which requires minimal teacher interaction), and the desire to have the course in a face-to-face setting (not suited for a la carte) a flipped classroom model of a blended learning approach was selected for the course. As discussed below, the instructor limited student exposure to COVID-19 by organizing the course material in a manner than allowed the students to be split into two equal sized groups that met once a week rather than having all students meet for two weekly sessions.

Course Information

Statics and Strengths of Materials is a required course in both the Architecture Engineering Technology (AET) and Construction Management (CM) curriculums and usually is taken during the second semester of the sophomore year. While this course is offered for both on-campus (for AET and CM students) and online (as part of the School’s fully online CM degree program), this project’s use of the blended learning model was only for the on-campus course. This course is a lecture only style course (no laboratory component) with a Spring 2021 enrollment of 40 students.

Every week students are provided with two online lessons which contain a combination of PowerPoint presentations (covering lecture style content with derivations, etc.), lightboard videos showing problem solving examples, and Internet-based videos (YouTube, etc.) highlighting real-life applications. There is also a weekly online quiz which reinforces key concepts as well as requires students to rework example problems from the online lessons (with different variables) or a similar problem.

Rather than having all 40 students meet for two weekly classroom sessions, two equal sized groups (based alphabetically on the students' last name) meet once a week. Since each classroom session is recorded using YuJa video software available through the University's Learning Management System (Canvas), students who are not assigned to a particular classroom session are required to view that lesson's content online asynchronously. Each classroom session starts with a 10~15 minute overview in which the instructor highlights the key concepts covered in the online lesson and provides an additional example(s). In doing so, he makes a concerted effort to relate the current lesson content to previous and upcoming lessons, the course, and real-life applications. The instructor intentionally limits the lesson overview to 15 minutes based on the finding from Swartz, Butler, and Laman whose literature review identified that typical student attention spans range from 5-15 minutes⁹. The remainder of the class time is devoted to a variety of hands-on learning activities including problem solving sessions, computer-based activities with commonly used software (MS Excel, Bridge Designer, and SkyCiv), and class discussions. Office hours for the course are offered in both on campus (at the instructor's office) and online (virtual) format. Virtual office hours for the course are conducted through Zoom and held twice a week for two-hour periods.

Evolution of Blended Learning

While the term "blended learning" (also known as "hybrid learning" or "mixed-mode learning") is defined in the educational literature a large variety of ways, the basic premise remains that it is an educational approach that combines online digital media with traditional classroom methods. Earliest references to blended learning were vague, and highly variable regarding the online technologies and pedagogical approaches used. Bonk and Graham's 2006 publication entitled "The Handbook of Blended Learning Environments: Global Perspectives, Local Designs" challenged the vagueness of earlier references and clearly defined blended learning systems as systems which "combine face-to-face instruction with computer mediated instruction"¹. Other researchers such as Hartman et al. (2007) expanded on this definition to include that blended learning "combines face-to-face classroom instruction with online learning and reduced classroom contact hours (reduced seat time)"⁶ while Chan and Koh (2008) concluded that blended learning is "the ability to combine elements of classroom training, live and self-paced e-learning, and advanced supportive learning services in a manner that provides a tailored learning"². A more current interpretation of blended learning comes from Friesen (2012) in which he suggests that blended learning "designates the range of possibilities presented by combining Internet and digital media with established classroom forms that require the physical co-presence of teacher and students"⁵.

To understand the development of blended learning, we must examine the evolution of technology-based training. Computer-based training has its origins with the emergence of mini-

computers and mainframes in the 1960s. One such example was a computer-based training network called PLATO (Programmed Logic for Automatic Teaching Operation) developed by the University of Illinois in 1963. Limited by the number of interface connections, mainframe-based training gave way to the use of satellite-based videos in the 1970s. This technology allowed companies to train their employees through video networks, empowering them to expand their training programs since the instructor no longer had to physically be on site. One of the most successful satellite-based training case studies is the Stanford University Interactive TV network. Stanford devoted resources to their video network in the 70's and 80's so that professors could hold classes in multiple locations at one time⁴. As technology continued to evolve, CD-ROMs emerged in the 1990's as a dominant form of distance learning technology. CD-ROMs had two major advantages: they were easily distributed via mail and they could hold large quantities of information. However, the limitation with CD-ROMs was the inability to for instructors to track student progress. This need led to the emergence of Learning Management Systems (LMS) which allowed educators the ability to monitor course completion, enrollment data, and user performance within the CD-ROM network⁴.

The use of computers to train employees gained popularity in corporate America in the late 1980s⁸. Shortly following the unveiling of the World Wide Web, the University of Phoenix became one of the first programs to offer formal online education programs. This prompted other for-profit and not-for-profit institutions to follow suit including New York University Online in 1998 and California Virtual University (consortium of 100 universities and colleges) also in 1998. By this time, computers were no longer just for companies or the wealthy few, but for the masses. As more households were able to purchase computers for the families to enjoy, computer technology advanced to include more immersive graphics, sound, and video capabilities while browsers increased connection speeds. Companies no longer had to distribute CD-ROMs to their users, since they could upload material, assignments, and learning assessments via the web to users who have access to this information with a click of a mouse.

Modern blended learning is delivered online. Ranging from webcasting (synchronous and asynchronous) to online video (live and recorded), learners now have a wide range of technology tools and applications at their disposal. Companies and institutions of higher education can educate students anywhere at any time, while online learners have access to courses anywhere in the world.

Methodology

This section provides detailed information as to how the blended learning model was evaluated to ascertain both its effectiveness in protecting student health during the pandemic and its impact on student learning. As such, it presents the methodology used to collect data at beginning and midway through the semester, as well as the type of qualitative data that was collected.

Pre-implementation Assessment

At the beginning of the course, the instructor provided his students with a brief orientation to blending learning through a short video entitled "Blended learning & flipped classroom"¹¹. While there is an abundance of videos available online that demonstrate these approaches, this video was selected based on its quality and clarity.

Following the orientation, an anonymous student survey was administered to assess the students' opinions of the blended learning approach. The questions were crafted to assess both student perceptions of how the approach will impact their learning and blended learning's potential for protecting their health during the pandemic. The survey was completed in class, was voluntary, and no incentives were offered for completing it. The following represent a representative sample of the comments received from the questionnaire:

What is your opinion about having this course on campus (versus fully online) during the current COVID-19 pandemic?

- I am delighted. The amount of math involved in this course makes it necessary to be live.
- While I am worried about the spread of COVID-19, I feel that the university is taking the necessary steps to protect us.
- I am glad the course is on campus. I really struggle with online classes.
- If everybody takes the safety measures seriously, I feel safe. I do worry that some students will not take the necessary precautions.
- It gives me better chances to ask questions.

Do you feel that the use of blended learning, combined with splitting the students into two equal sized groups that meet once a week, helps minimize your exposure to COVID-19? Why or why not?

- Seems logical to me, splitting the courses reduces our chances of exposure.
- While it does minimize my chance of getting COVID, there is still a risk.
- It is a good idea, but it will not work unless everybody takes all the other precautions.
- It helps reduce the risk of infection, but not as well as fully online.
- It combines the best of both worlds. Everybody gets some in class time while minimizing exposure to COVID-19.

Do you see any advantages with combining online sessions with classroom instruction?

- The online component allows me to learn at my own convenience and pace.
- The biggest benefit is being able to solve the problems in class with the instructor's help rather than me struggling on my own.
- This format works for students who like online and in class.
- Live sessions allow me to pose all my questions in class rather than via email.
- Leaves more time for professor to answer questions during class.

Do you see any disadvantages of combining online sessions with classroom instruction?

- The logistics could be confusing for some folks (alternating between live and online).
- I want more class exposure; half time is not enough.
- It might be more of a struggle to get answers to my questions (when the lesson is online).
- It might require me to learn the material on my own, which can take more time.
- I could see how some students might not review the online content when it is not their assigned date for the live class.

What are your opinions regarding the student's role in the "blended learning" approach?

- I like it because it allows students to come to class with questions, not leave class with questions.
- It takes more work at home to succeed, but I think I will learn more.
- Students must review the material ahead of time and come to class ready with questions.
- It puts more responsibility on the student to teach themselves. Their success is completely in their hands.
- It is critical that students log into Canvas regularly to keep up with the readings and assignments.

What are your opinions regarding the teacher's role in the "blended learning" approach?

- The teacher must be able to answer emails and be available to students as much as possible.
- Dr. Rogers needs to make sure the information is provided ahead of time and be willing to help students during class.
- The online materials must be good enough so that the student will not need help with the online work.
- Flexibility will be critical since students differ regarding how well they perform online vs in-class.
- It seems there is less teaching from the teacher. He works more like a coach.

Do you have any concerns regarding the instructor's use of the "blended learning" approach for this course?

- I have a concern regarding the quizzes taken at the end of the lectures online. I feel like I usually have too many questions unanswered and am not fully ready for the quiz.
- I am afraid I might easily fall behind if I do not understand something.
- My only concern is that blended learning may not be effective for this challenging of a course.
- Since I am not very tech savvy, I prefer face-to-face learning over online.
- The instructor needs to be aware that there are more distractions with learning online.

The information collected from the survey was very useful in developing an understanding of the students' perceptions of blended learning and their concerns relating to exposure to COVID-19 in the classroom. Having this baseline information also allowed the instructor to design and implement lessons throughout the course that addressed the students' concerns. For example, the instructor made sure that the online lessons included numerous examples.

Mid-Semester Assessment

A student perception survey was administered midway through the semester. Like the survey used at the beginning of the semester, this survey was also completed anonymously, voluntary and no incentives were offered for completing it. As shown in figure 2 below, the survey consisted of two demographic questions on gender and major and six open-ended questions.

AEC 270 – Spring 2021
Blended Learning: Mid-Semester Questionnaire

The following questions relate to the instructor's use of the "blended learning" approach used in this course. The instructor appreciates your honesty in answering the questions and assures you that your answers will not have any impact on your course grade. Please do not write your name anywhere on this sheet.

1. Please indicate your gender:

- Female Male

2. What program are you enrolled in?

- Architecture Engineering Technology
 Construction Management Other _____

3. So far in the course, are you satisfied with the safety precautions (social distancing, masking, etc.) used to protect your health and well-being during the current COVID-19 pandemic?

4. Do you feel that the use of blended learning, combined with splitting the students into two equal sized groups that meet once a week, is helping to minimize your exposure to COVID-19? Why or why not?

5. Is there anything that the instructor could do differently with the instruction of this blended course to better protect your health?

6. So far in the course, what did you like most about the blended learning approach?

7. So far, what did you like least about the blended learning approach used for this course?

8. If you could offer one suggestion to improve the blended learning experience for the remainder of the course, what would it be?

Figure 2. Mid-Semester Survey

Answers from the open-ended questions were evaluated by reading through the students' answers and summarizing their responses. Information collected relating to student gender and major was also collected to determine if a correlation exists between these parameters and student perceptions regarding blended learning. This type of analysis will most likely be performed at a later date, once multiple semesters of data have been collected and the sample size is statistically significant.

Results:

This section presents the qualitative results collected through the mid-semester survey regarding student perspectives of the blended learning.

Qualitative Data Analysis

Students completed a survey midway through the course which contained six open-ended questions addressing their experiences with blended learning; both in terms of its use to limit student exposure to COVID-19 and its impact on their learning. The following provides a representative sample of the comments received from the questionnaire:

So far in the course, are you satisfied with the safety precautions (social distancing, masking, etc.) used to protect your health and well-being during the current COVID-19 pandemic?

- Yes, everything that can be done is being done.
- I personally do not agree with all the precautions but go along with it to have a face-to-face course.
- Yes, I feel these extra steps keep me safe.
- I think all the precautions are pointless: COVID-19 has a higher survival rate than the flu.

Do you feel that the use of blended learning, combined with splitting the students into two equal sized groups that meet once a week, is helping to minimize your exposure to COVID-19? Why or why not?

- Yes, it helps by minimizing my exposure to the virus.
- It helps minimize our risk by keeping us distanced (much smaller class size).
- I have mixed feelings. It helps minimize my risk to COVID-19 in this class, but I am still at risk coming to and from this class.
- No, I do not feel that COVID-19 is really that big of threat.

Is there anything that the instructor could do differently with the instruction of this blended course to better protect your health?

- No, the instructor has done great under the circumstances we have been put under.
- Allow students the option of not attending class once a week.
- Not really, he is executing the class very well.
- While the instructor disinfects our desks, perhaps he should have the custodians disinfect the entire classroom before each class.

So far in the course, what did you like most about the blended learning approach?

- It allows us to come to class at least once a week. This motivates me to learn.
- I really liked the instructor's use of virtual office hours (in Zoom). Since I am a bit shy, I feel more comfortable asking questions via Zoom than I do in a live class.
- The blended approach seems to have greater flexibility than online courses.
- Since the lectures are all recorded, I can go back, and re-watch videos as needed.

- I like that I can do a large amount of my work from home, on my own time.

So far, what did you like least about the blended learning approach used for this course?

- I do not like having my in-class time limited to once a week.
- At times I forget to watch the videos for the classes that I am not attending live.
- It seems that it gives the student more work to do (having to teach ourselves the material online).
- Dr Rogers is good live; I do not think the class should be blended.
- The day I am not assigned to come to class, I struggle to understand the concepts.

If you could offer one suggestion to improve the blended learning experience for the remainder of the course, what would it be?

- Provide larger classrooms so that all students could meet face-to-face twice a week.
- For the days that I am not in class, use Zoom rather than videos recorded during class.
- Sometimes it can be difficult to hear the videos since the professor wears a mask.
- Allow students the option of attending class every session (twice a week) for those who want to.
- Do more in-class examples.

Discussion:

This project entailed the conversion of a traditional classroom style course into a blended learning course that integrated online elements with in-class teaching elements. Up until this project, the School of Construction and Design had never used a blended learning course in their program. Whereas the primary incentive for this conversion was to decrease the risk of student exposure to COVID-19 virus by shortening face-to-face instruction time, a secondary motivation behind the project was to assess how students would respond to the blended learning model and if the model could be an effective tool to improve student learning. By reviewing the qualitative (pre-implementation and mid-semester) assessments of the course, the instructor gained valuable insight regarding the model's effectiveness in protecting student health, student reactions to blended learning, strategies for better integrating the online and classroom elements, and approaches for improving student learning by keeping students engaged and motivated.

Observations relating to the effectiveness of blended learning in protecting student health and wellbeing during the COVID-19 pandemic include:

- Students feel that the ability to reduce their in-class meeting time by half, by posting course lessons online, was helpful in minimizing their exposure to the virus.
- In addition to reducing each student's number of classroom sessions by half, an additional benefit of the blended learning method approach was that it facilitated social distancing by reducing the class size.

- While blended learning is an effective tool for reducing student exposure to COVID-19, it alone cannot work unless students practice other safety measures such as wearing masks, social distancing, and frequent hand sanitation.
- While there is not a one-size-fits-all strategy for minimizing health risk and enhancing student learning during the COVID-19 pandemic, the blended learning model's flexibility and effectiveness makes it a very viable option for educators at all levels.

In terms of the overall student reactions to the blended learning model and the model's impact on student learning, student observations include:

- Students like the flexibility of the online component paired with the interactive nature of the classroom sessions.
- The students embraced the use of virtual office hours (held weekly through Zoom). Feedback collected through the mid-semester questionnaire indicates that they feel more comfortable asking questions in an online format than in-person at an instructor's office or in class.
- Overall, students liked the active learning style of the classroom sessions (versus having a traditional lecture during this period) since they provided them with opportunities to get direct assistance from the instructor.
- Students prefer learning in an in-class environment. While the blended class format provided them with the opportunity to have a face-to-face class at least once a week, many commented in that they would prefer having in-class sessions twice a week.
- Blended learning requires students to take a more active role in their learning while also developing self-directed learning skills. These skills are vital in the construction management profession since construction depends heavily on autonomous problem solving and continuous learning.
- When integrated properly, the online and classroom components can complement each other nicely. Whereas the technology-based components (Lightboard, YouTube, etc.) are affective in providing students with needed background and application information, the classroom element provides them with an opportunity to get instructor guidance and practice applying concepts.

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