

Lessons Learned — Online Class (CE 272)

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ABSTRACT

In the age of rapid developing communication technologies, online teaching and learning has become a common practice in several institutions of higher learning. Online courses traditionally are more effective for learning straightforward content and concepts. Such pedagogy may not necessarily enhance cognitive thinking and social development aspects among learners. However, virtual course development has been on the upsurge recently because of its several advantages; especially for its role in continuing and distance education and the “flipped classroom.” The course selection process for such an endeavor needs careful consideration. In fall 2012, the Department of Civil and Environmental Engineering (CEE) at Michigan State University developed an online version of CE 272 (Civil and Environmental Engineering Analysis) for summer 2013 based on several considerations including: (a) content-oriented nature of the course, (b) potential for helping to reduce time to graduation (by providing an additional offering of the course), (c) revenue generation potential, (d) prospects for promoting technology-mediated instruction, and (e) compatibility with the “flipped classroom” model. Subsequently, the department offered the first online version of the course in the summer of 2013. This paper documents various challenges related to the (a) developing the course materials, especially those related to the technology needs, (b) assessing the students, and (c) availability of resources to the faculty on campus at Michigan State University. In addition, a brief discussion on the teaching philosophy and the avenues of forthcoming improvement are included in the paper. The future goal is to compare assessment indicators between an online and a flipped classroom approaches to gauge the student learning.

INTRODUCTION

In fall 2012, the Department of Civil and Environmental Engineering (CEE) proposed to develop an online version of CE 272 (Civil and Environmental Engineering Analysis) for summer 2013 based on the following key considerations:

- content-oriented nature of the course,
- potential for helping to reduce time to graduation (by providing an additional offering of the course),

- available content in a format amenable to an on-line offering (minimal time spent in developing new content),
- revenue generation potential,
- prospects for promoting technology-mediated instruction, and
- compatibility with the “flipped classroom” model.

The development of the online course was supported through teaching innovation funding by the Associate Dean for undergraduate studies and Center for Engineering Education Research (CEER) in the college of engineering at Michigan State University. Recently, the course was offered to fifteen (15) engineering students who enrolled for summer 2013. This summary highlights some of the lesson learnt including accomplishments, challenges, experiences acquired and future improvement needs during the development process and the offering of the online class. In addition, the teaching philosophy of the course is briefly presented,.

COURSE IDENTIFICATION FOR ONLINE OFFERING

CE 272 is selected because it is a required course for undergraduate program in CEE. The course consists of three major components or modules: (a) computer-aided design (AutoCAD), (b) probability and statistics, and (c) engineering economics. While mastery of the course material will not make the learner an expert in any of the three areas, it will help prepare the learner to make more progress on their own in the context of other classes (e.g., use AutoCAD in developing a site plan or technical drawing) and with more advanced applications in the various areas of civil and environmental engineering. Currently, the computer-aided design component is taught in a laboratory “hands-on” setting. There are a few small projects, homework, and a practical exam. The other two components are taught in more traditional lecture modes although student participation and contribution to class are highly valued. In all three components, the emphasis is on practical application rather than theoretical development. This emphasis is most apparent in the probability/statistics segment where considerable time is spent on determining how/when to use and how to interpret statistics rather than mathematical derivations.

NEEDS FOR AN ONLINE CLASS DEVELOPMENT

This section describes the training needs and purposes of various tools needed for an online class development and offering.

Training Needs

The following activities/trainings were accomplished during the course of developing the online version of the course:

1. “Desire2Learn (D2L)” learning management system (LMS) through faculty training sessions by Distance Learning Services at Michigan State University (MSU).
2. “Adobe Presenter” through technology training from libraries computing and technology
3. “Camtasia Studio” through online training videos by TechSmith®

4. “Adobe Connect Pro” through technology training from libraries computing and technology

Purpose and Use of Various Tools

The purposes of above mentioned tools are briefly discussed below in context of the online course development:

- The online CE 272 class was managed by using the recently available learning management system **D2L**. The adoption of this system facilitated the incorporation and use of several new features available for this class. For example, online assessment of quizzes, use of calendar features for upcoming events and time management, and use of drop boxes for online assignment submissions.
- Initially, all the online lectures were recorded using the **adobe presenter**, for module 2 (probability & statistics). The software is an add-in to PowerPoint and is available free to MSU faculty. In addition, it is suitable for development of course content, especially if the lectures are available in PowerPoint. Once, the lectures are recorded (voice and video), it is very convenient to convert the recording into a video. Further, the recorded videos can be edited within the software. However, after the first few weeks of the course development, several limitations were observed in adobe presenter. These concerns are briefly mentioned below:
 - a. In adobe presenter, the commonly used voice and video file formats (e.g., mp3, and mp4) are not available. The voice and video recording can be saved as a zip package or other adobe file formats.
 - b. The editing options for the recorded video files are very limited.
 - c. The adobe presenter is only an add-in for PowerPoint. Therefore, for screen capture videos other software such as adobe connect need to be used which has similar issues with video files formats.
 - d. The video files can be zipped and uploaded as a package on the MSU server, i.e., *store media*.
- Based on the above mentioned issues, the Camtasia Studio was utilized for developing the online content i.e., videos from screen capture (demonstration examples) and PowerPoint (lectures). The advantages for using the Camtasia are discussed below:
 - a. Videos can be recorded from PowerPoint and computer screen at the same time.
 - b. The workflow is very convenient and efficient for editing and combining various clips of the videos.
 - c. Several clips can be easily combined to make a single continuous video.
 - d. Videos can be saved in several formats including the most common mp4 and flash formats at various resolution and frame rates.
 - e. The final videos can be easily uploaded on the MSU server through media space.

- The online office hours were managed through video conferencing by using ***adobe connect*** software. The software is available free to MSU faculty. In addition to video conferencing, the software was used to monitor online exams.

Detailed course syllabus and schedule were prepared for the following three online modules of the course:

1. AutoCAD: May 13 to June 14, 2013
2. Probability & Statistics: June 17 to July 19, 2013
3. Engineering Economics: July 22 to August 15, 2013

The developed *course syllabus* for an online version of the class highlights the administrative needs, course learning objectives and assessment requirements for the course. The *course schedule* describes the details of contents, objectives, reading materials, and assignments to be covered in each week during the semester.

TEACHING PHILOSOPHY FOR THE ONLINE COURSE

In this section a general pedagogy or philosophy adopted for the online class is briefly presented. The discussion will highlight the following general question regarding the teaching and delivery aspects of the online course:

- How are lectures recorded?
- Lecture length (i.e., are those full length or broken down into more manageable short lectures)
- How do students respond to and use the lectures?
- How are the video conferencing programs used?
- Does the professor conduct regular office hours on-line?
- How do students interact with the professor and the course?

While the paper provides a sense of the technology that can be used to deliver an on-line course, the answer to above queries will help in fully understanding the experience.

Lectures Recording

Lectures were recorded in video format, including audio and visual support. Camtasia Studio® software by TechSmith was the utilized to record lectures. Video format included audio of the instructor's voice and screen contents. Visuals were shown from various formats, primarily PowerPoint slideshows and AutoCAD software. Most often the contents on screen were real-time demonstrations of digital drawing tasks. The recorded videos were uploaded to the University's site for streaming videos. These streaming videos were then linked to the course's password protected LMS, D2L.

Lecture Lengths

Lectures were broken down into manageable short videos. Video duration ranged from three to ten minutes. Splitting lectures into segments of maximum ten minute length allowed for a better user experience especially using streaming videos. The videos

covered the content of lectures and explanation of basic concepts while PowerPoint slides were also made available to students. Short example videos were developed to demonstrate solution to mathematical problems, especially in probability and statistics and engineering economics modules of the course. These examples were developed using a tablet and screen capture with each topic. Such problem solving exercises helped students to understand certain concepts better. Subsequently, the students were assessed and evaluate for their understanding in the homework assignments, online quizzes and final exams. Figure 1 shows examples of course schedules for a week for AutoCAD and probability and statistics modules of the course.

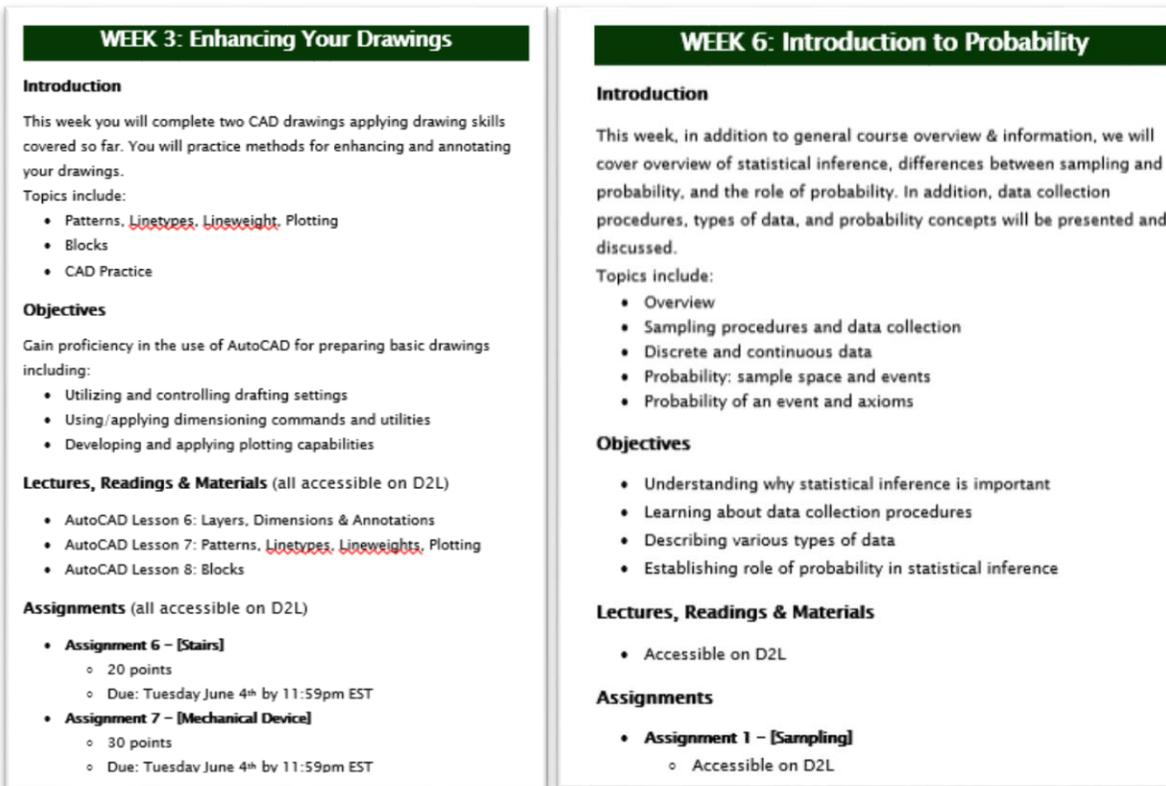


Figure 1 Week Schedules for Modules 1 (AutoCAD) and 2 (Probability and Statistics)

Students Response

Faculty recommended that students designate a split screen or use dual monitors for the benefit of this online delivery. This allowed students to watch instructional videos while simultaneously attempting similar drawing tasks. Students have reported benefiting most from use of a dual monitor display as well as the ability to pause and replay portions of video lectures.

Video Conferencing

Conferencing programs were used for live office hours as well as live assistance during exams. Adobe Connect® was selected as the course conferencing platform. Adobe Connect® offers multiple features that were utilized for this course including:

- password protected online meetings,
- group messaging,
- individual messaging,
- file sharing,
- screen sharing,
- audio conferencing,
- video conferencing, and
- mobile conferencing.

All features were utilized on an “as-needed” basis during office hours. In addition, video conferencing was also utilized during the AutoCAD exams as a hub for live communication with the instructor. To complete a live *practicum* exam at a previously scheduled time, students connected remotely via the Internet to a designated computer on campus that the instructor had prepared for computer sharing to that individual student. Students completed the exam using University software they had connected to. Students were instructed to remain logged into the course conferencing site on Adobe Connect® to stay in real-time contact with the instructor regarding any further instructions, time warnings, updates or inquiries.

Office Hours and Student Interaction

The instructors conducted regular online office hours. At the beginning of the semester, students were asked to let the faculty know which days and times (including time zones) during the week they would most likely be working on course assignments. Based on responses, the instructors selected two times per week to benefit as many students as possible. In this case, Monday evenings 7:00-9:00pm EST and Thursday lunch hour 12:00-1:00pm EST were designated for live office hours. Additional availability or online conferencing were scheduled by advance appointment upon student’s requests.

The development and delivery of an online class entails several challenges, the following section documents some of such challenges experienced by the instructors while this online class offering.

CHALLENGES FOR AN ONLINE CLASS

The course development process and actual offering of an online class posed several challenges related to technology needs and assessment requirements for the class. These challenges and their probable solutions are briefly discussed in this section.

Technology

Learning and getting accustomed to various types of technology needs time and proper training. In addition, various types of technologies need to be integrated to accomplish the desired objectives of an online course. The following are the technology related components:

- Recording lectures in Camtasia. A good professional microphone should be used for this purpose. Editing videos and voice recording can be accomplished within the Camtasia Studio.
- Recording example solution videos in adobe connect using a tablet. Getting used to writing on a tablet needs some practice. These videos should be integrated in the recorded lectures.
- Understanding the video conferencing in adobe connect. A webcam is needed for this purpose. It was observed that the use of a headset with microphone and speakers is a better choice for this purpose to eliminate the echo during online voice or video conferencing, especially when several participants are involved.
- Saving the video files need significant amount of storage depending on the file type. Therefore, a large external hard drive is strongly recommended.
- Uploading lecture videos on the media space web site (www.mediaspace.msu.edu) is a practical solution. The link to the video can be made available to the students on D2L course website. However, separate PowerPoint lecture files can be uploaded on the D2L course website because students can't download and print the lectures via a video.

Assessment

Assessment of students is one of the major challenges in an online setting. This concern even becomes more important when hand written solutions (mathematical formulations) are desired for considering the partial credits. Anticipating such concerns, especially for modules 2 and 3 in this course, the following assessment activities were planned:

- Online quizzes (multiple choice)
- Homework's (scanned file need to be uploaded)
- Final exams at the end of each module (multiple choice and problems solution)

To address the above mentioned challenges, the following are the exam requirements (mentioned in the course syllabus):

Online Exam Format: Exams will be conducted online. Students will connect remotely (from wherever they are in the world) via the Internet (a high speed connection required) to a designated MSU computer in East Lansing. Students will complete the exam using the MSU software they are connected to remotely. Faculty will provide further instructions before the exam.

Exam Content & Procedures: The AutoCAD exam is a practicum challenge! Students were instructed to complete a specific drawing within a designated amount of time. The exam was scheduled by appointment and was proctored live, from a distance. The exams are open book and open notes. For modules 2 and 3 of the course, the following options were available for students:

Option 1: A student can take an in-class exam on campus if he/she is available on campus at the end of each module (i.e., twice in the semester).

Option 2: A student can take the exam online with a webcam. In this case the exam was a combination of an online and paper solution. The paper solution part of the exam were scanned and uploaded on the D2L course webpage in the final exam drop box.

The course materials and needs required an access to a scanner for submitting homework assignments and exams (if needed), especially for probability & statistics and engineering economics modules. Students need to scan their assignments and exams showing the solution process. This will assist the faculty to assign partial credit (if any). In case the scanned *pdf* files cannot be uploaded on time, a temporary alternative was to upload high resolution pictures of the work on time and subsequently submit scanned files. It was the responsibility of the student to upload readable/legible files to cover the work.

FEEDBACK ON LESSONS LEARNED AND FUTURE IMPROVEMENT

Several challenges and potential solutions are mentioned above. The following sections highlights the important lessons learned during the first offering of CE272 online this summer and future needs for further improvements and innovations to enhance the learning in an online and class settings.

Lessons Learned

- The choice of online class is important factor in its overall success. It is important to recognize that every course may not be an appropriate candidate of an online offering, especially if more interaction and cognitive pedagogy are needed.
- The selection of CE 272 online was based on the content-oriented nature of the course. The first offering of the CE 272 online was well received by the students enrolled in summer of 2013. The post-evaluation of the class by students is a testimony to that fact.
- The development of an online class needs substantial time and resources. While faculty training for the appropriate tools is a continuous process, it takes significant amount of efforts to learn and integrate all such tools.
- Camtasia Studio is comprehensive and user-friendly software for recording and developing video lectures for the class. The video editing and combining options are very helpful in producing professional and high definition videos in various common file formats.
- Media Space (cloud service) can be used to upload all the class videos and link to those videos can be posted on the course website (D2L). The streaming is significant faster for the videos posted on Media Space than those posted in Store

Media. It should be noted that Store Media is an old system and much slower than Media Space.

- The use of tablet was really challenging in making demo examples in modules 2 and 3. A Wacom tablet was tried during the first offering of the CE 272 online. Such tablets for writing mathematical equations and solutions are not very responsive. The quality of writing is also not good because the user has to write on the tablet and constantly monitor the writing on the computer screen. Therefore, it is highly recommended that to accomplish such endeavors appropriately, a screen with digitizer pen should be used. The example of such tablet is MS Surface Pro with a digitizer pen or other tablet computers with a digitizer pen for writing on the screen.
- The students could use a free application “*CamScanner*” for smartphones to take digital pictures of their multiple pages of homework. The application can convert the photos to a pdf format and subsequently the pdf file can be uploaded to a drop box on the course website. Therefore, the use of such application will eliminate the need for a scanner for students if they have a smartphone.
- Assessment of the students is one of the major challenges in an online setup. The alternative methods need to be explored and assessed, especially if the class size becomes large (i.e., more than 30).

Future Improvements

- Since, CE272 online contains three separate modules, each module can be advertised separately to fulfill needs of other colleges.
- More assessment methods, especially for exams will be explored and their practical adoption considering the international students will be evaluated.
- The online examples for modules 2 and 3 will be improved by using a tablet with a digitizer pen and a document camera.
- The flipped or hybrid class room models will be explored during the regular semester offerings of in class CE272 to enhance student interactions and more cognitive pedagogy in the class room.

CONCLUSION AND RECOMMENDATIONS

The choice of the class for an online offering is a key to its success. Several technologies need to be learnt and implemented for developing the course materials. There is a learning curve for the instructors. While the first few offerings of the online class helps in setting up the materials, substantial improvements can be anticipated over future offerings. Student assessment is one of the key challenges in the virtual class offering, especially when mathematical solutions are expected. However, considering the advantages and benefits of such endeavors, several alternative assessment techniques can

be adopted based on the class audience. The materials developed for the online class is being used in the flipped or hybrid approaches during the regular semesters for the in-class course offerings. Such approach is very much appreciated by the learners. It will be useful to compare the learning indicators for different teaching pedagogies (i.e., online, filliped/hybrid and in-class). The appropriate assessment data over time are being collected for different teaching approaches to assess and compare learning of the materials.

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