

Teaching AutoCAD in the Virtual Classroom

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University class sizes are often limited by available university space. This became a major problem in Oklahoma State University's Construction Drawings class that covered both print reading and AutoCAD, which is a required Freshman level course. The class size was limited to 28 students in both the Fall and Summer semesters due to the size of the available computer lab needed to teach the CAD portion. The initial reaction was to eliminate CAD from the course, and concentrate on print reading, with CAD being offered as an elective. However, the instructor of record, decided students should be given the opportunity to learn some basic CAD skills. With 35 students enrolled and computer lab available on campus to accommodate a class that big, the decision was made to teach the print reading portion of the class in a traditional classroom and CAD in a virtual classroom. The experience was deemed successful by both the students and the professor through evaluations. This paper discusses the course structure, the computer software used to produce the virtual classroom, the student evaluations of the course, challenges that were overcome, and lessons learned.

Key Words: AutoCAD; Construction Drawings; Online; Camtasia

Introduction

Limited resources affect the size and number of times a course is offered. Whether it is the size of the classrooms or the number of faculty members in a particular department, growth is difficult to support without additional resources. With decreasing budgets and increasing costs, universities are managing class schedules with sophisticated software that maximizes classroom usage, but in turn minimizes flexibility (Leibowitz, 1998). It is nearly impossible to add seats to a computer lab just to accommodate the varying enrollment from semester to semester.

This was a problem that the Construction Management Technology Department at Oklahoma State University faced for several years in the CMT 2253 Construction Drawings and CAD Course. The course was designed to be half Blueprint Reading and half Computer-Aided Drafting. The class was limited to 28 students every semester due to the size of the available computer lab. Initially, it was a course with only a spring semester offering, but a summer course was added due to increased enrollment.

By Spring 2008, the course was identified as a "bottleneck" in the program. Offering the course to 28 students in the Spring and Summer semesters was no longer keeping up with the demand. The Department had to make a change. The course either needed a third offering, increasing current faculty teaching loads; or the class size needed to be increased. In turn, the class would have to be moved out of the computer lab, eliminating the use of computers in the traditional classroom.

Course Structure

Initially, the decision was made to move the class out of the computer lab, and into a traditional lecture hall. The scheduling for the 3-credit hour course changed from a Monday and Wednesday from 10:30-1:20 to Monday, Wednesday, Friday 12:30-1:20. The idea was to remove the Computer Aided Drafting (CAD) from the course and only teach print reading. The CAD would then be addressed only in an elective course.

After much thought, the instructor decided that CAD was too important to eliminate. Having the skills to communicate graphically are important in the construction industry. The point was not to make draftsmen out of the students, but to impart enough AutoCAD knowledge that the students are not afraid of the program, and have enough experience to draw simple problems that occur on the job. Sometimes a graphical representation of a problem is more effective than words describing the same problem.

The idea of teaching the AutoCAD portion of the course online came about from a conversation with a Mechanical Engineering Technology professor, who was using a program called Camtasia to produce safety videos. The program would record the computer screen with sound in a format that can be posted to the University Online Classroom for review, essentially providing a podcast. The video file can be viewed from any device with internet, but in order to really get the most out of the lecture, students needed to be on a computer with AutoCAD. The instructor recorded how to do each AutoCAD assignment step-by-step and encouraged students to watch the video and then complete the assigned drawing. The video could be paused, rewound, and viewed as many times as needed.

On Mondays and Wednesdays the CMT 2253 Construction Drawings course met for Print Reading Lectures using the American Technical Publishers Print Reading Books. The lecture consisted of PowerPoint slides, Blueprint reading, and discussion. To ensure that the students were prepared for lecture they were required to post two multiple choice or True/False questions that pertained to each assigned chapter in the Discussion section of the online classroom prior to class; this was inspired by Jose Fernandez-Solis' 2007 ASC presentation titled *Grounding the Use of Instructional Technology in Principles, Teaching Philosophy, Course Goals and Disciplinary Values*. Students received points for posting on time, and their questions were used as approximately 45% of the questions on the three tests. The remaining portions of the tests were devoted to reading actual prints (50%) and additional information deemed pertinent by the instructor (5%). The students print reading skills were also evaluated through an online quiz that was typically 30-40 questions per print set. Since each class period typically covered a new print set, students took two online quizzes per week. The questions at the end of each chapter in the book were used to make a pool of questions for the quizzes. About fifty-percent of the pool questions were randomly selected to form each quiz. The quizzes were open, or available, for one week after each lecture, and students were allowed to take it up to five times, knowing that they would get random questions each time.

The Friday classes were virtual and devoted to CAD. The *Residential Design Using AutoCAD 2008* by Daniel John Stine text was selected for the AutoCAD portion due to its descriptive nature and small assignments that reinforced the points of every chapter. The weekly CAD Assignment and lecture based on the aforementioned text were posted on the University Virtual Learning Environment or Course Management System, Desire 2 Learn, on Friday and were due the following Wednesday. This allowed students to listen to the lecture and complete the assignment on their own time, and also gave them the opportunity to ask questions. The AutoCAD assignments began small with drawing architectural objects and progressed to floor plans, elevations, and sections.

The Computer Software

The online lectures were produced using Camtasia Studio 5. The software is a video-based screen capturing software that essentially records the computer screen with or without voice in an AVI format; it also allows the addition of a webcam, if a visual recording of the presenter is desired. The software was purchased through the Oklahoma State University Institute of Teaching and Learning Excellence for a little over \$100; if had it been purchased as a single license online, it would have cost \$299.

Camtasia has the capabilities of recording the entire computer screen, or a smaller defined window. The software was originally designed to record software tutorials, but has been adapted to many applications. Some of the common uses of the program besides software tutorials are recording narrated PowerPoint presentations, or other class notes and website tours. Using narrated PowerPoint presentations through Camtasia eliminates the need for students to have PowerPoint on the viewing device, and also protects the slides from being easily reproduced.

When the Camtasia program is opened it brings up a welcome screen (*Figure 1*) that allows the user to make a new screen, voice, or PowerPoint recording, or import new media. Recent projects also show up, so they can be accessed quickly through the welcome screen.



Figure 1: Camtasia Welcome Screen

Camtasia is surprisingly quick and easy to learn, and offers online tutorials, and in the software. Each time a new recording is initiated, the Camtasia Recorder pops up and allows the user to define the audio and camera options along with the area to be recorded. It is helpful to have the ability to select different areas to record, so multiple programs can be open at the bottom of the screen, and they are not part of the recorded area. Also, it allows the user to record one window, while reading or paraphrasing from another.

A few special features of Camtasia located on the recording screen that are very useful when teaching AutoCAD are located under the *Effects* tab. The instructor has the ability to turn on sounds that are associated with the keyboard and the mouse. Students can see and hear the professor type commands, and can hear each time the mouse is clicked. The cursor can be highlighted with different shapes and colors so students can follow it around the screen. Additionally, a mouse click not only has a sound, but it can also have a color associated with it in regard to what side of the mouse is pressed; so students can differentiate a left mouse click from a right.

Multiple files can be grouped together to form a presentation. As files are recorded they can be saved for later, or added to the current presentation. Camtasia also provides a storyboard at the bottom of the screen that indicates the presentation timeline. Below, in *Figure 2*, the presentation consists of five different recordings that make up almost two hours of instruction. The recording times vary due to the different topics that were covered in each recording, and interruptions that occurred during the recording. Since professors typically cannot control if their phone rings or people knock on their office door, the software allows the videos to be cut and rearranged as necessary. The storyboard also allows the user to preview the recording before it is produced for student use.

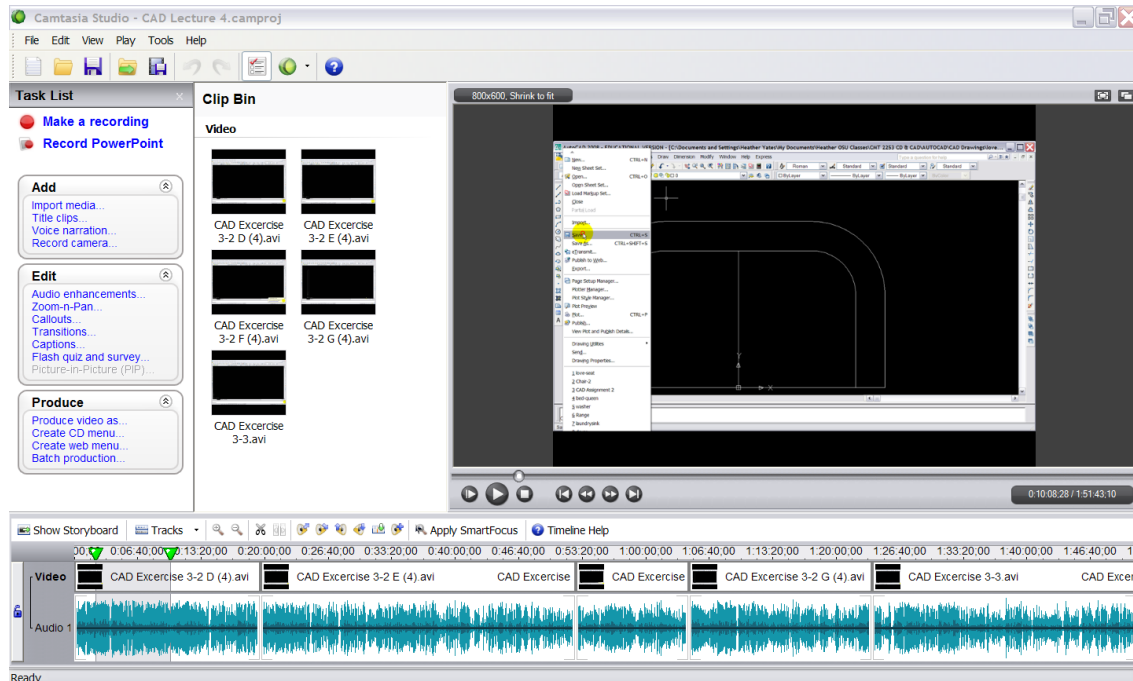


Figure 2: Camtasia Recording Screen

Once the video recording is completed, the file must be produced. Camtasia offers preset formats for the Web, CD, iPod, and Blog, and also has custom formats like Windows Media Steaming Video, Flash, and Quicktime Movie. An introduction and table of contents can also be added to the video before it is rendered to a sharable format. The rendering process is an internal computer function and does not require any additional input from the user. Once the rendering is complete, the video starts playing in a new window. Typically, the rendering process takes about the same amount of time necessary to view the video. Having a dual core processor or two computers is recommended if other computer work is planned during the video production.

Since teaching AutoCAD is essentially a software tutorial, the Camtasia software worked well. The students could go to any computer with an Internet connection and Windows Media Player and watch the lecture, which was a visual and audio recording of how to do the assignment. Unlike a traditional classroom, the students were able to pause, rewind, or fast-forward depending on their understanding of the particular assigned tasks. Many students would have AutoCAD open while they were watching the video so they could pause the video and draw immediately after the concept was demonstrated.

Student Evaluations of the Course

Two forms of evaluation were used in this course. The formal evaluation provided by Oklahoma State University was given at the end of the semester and assessed the entire course. An informal evaluation was also given after the completion of the fourth AutoCAD assignment that primarily evaluated the delivery method. Both evaluations were useful and provided good suggestions for improvement. Overall, both surveys reflected a positive overall assessment of the course, providing triangulation. It is important to note that not only was this the first time for Virtual AutoCAD, but it was the first time that the instructor had ever taught the course.

The formal evaluations were surprisingly higher than expected on the overall course. There were 25 evaluations submitted, and the overall evaluation of the course was 3.67/4.00 when the Construction Management Department average for the 2007-2008 academic year was 3.45/4.00. The comments on the back of the Formal Student survey of instruction included:

- Course : – “CAD was very interesting, I learned a ton!”
- “The (CAD) lab (portion of the class) was set up very well.”

More insightful information was gained through the informal evaluations of the class. The questions that were asked along with the student's answers are listed below:

1. Have you ever taken a CAD Class before?

Yes – 23% No - 77%

2. Do you like the format for teaching the AutoCAD?

Yes – 88% No - 12%

3. What is your favorite part about the current format?

(Compiled and summarized by instructor)

(Listed in the order of the most frequent response, with the frequency of the response noted in front)

(11) Learning at my own pace; Not getting left behind; (Pause, Rewind, Review)

(10) No Friday Class

(3) Can do it on my own time

(3) Since assignment is posted and I already know CAD, I don't have to sit through a lecture; Just check video for things I forgot how to do

(2) Can do it at home

(1) Good Explanation

4. Do you have any suggestions to make it better?

(8) Shorter Videos

(2) Tutoring Hours

(2) Free AutoCAD for home use

(1) Open Class on Fridays in a Computer Lab

(1) Set times for groups to get together and work (but we could do this ourselves)

5. On a scale of 1 (least) to 10 (most) how effective do you think the format is?

Average – 8.03

Improvements Made- In Response to Informal Survey

The following improvements were made as a result of the feedback of the informal survey: Future videos were broken down into segments, so for example; lecture 9, which covered doors and windows, had two videos that were posted, one on each topic. It did not take any more time to produce two videos, but it made it easier for students to navigate the videos. Also, free tutoring hours were set up in addition to the instructor's office hours. The tutor was a senior Construction Management student who was competent in AutoCAD.

Challenges

There were two major types of challenges in this endeavor: Challenges that primarily affect the instructor and challenges that are more student-focused. The initial instructor challenge was learning how to use Camtasia, and relearning AutoCAD, since it had been at ten years since the instructor had used the program. Learning two things at once takes more time, and requires focus and determination. It actually took about 50% more time for the instructor to practice the AutoCAD and record the videos than it would have taken to prepare for a traditional CAD course.

Another instructor challenge was inputting all of the quizzes online, and correcting any online grading mistakes. The computer will only count answers correct if they are input exactly the same. The multiple choice and true/false questions were not a problem; it was the fill-in-the-blank questions that would require words and/or numbers. Occasionally, differences in word spacing, or adding a space at the end of a word or phrase would count an otherwise correct answer incorrect. It was also a problem when numbers were answers. Students input numbers in many different ways like 1'-4½" could be entered 1'4 ½" or 1-4 ½ etc. The solution that worked for this class was to

actually let the students see the answers at the end of the quiz, and if their answer was right, and it was a formatting issue, the instructor would adjust their points accordingly. Students were required to take a screen shot, and e-mail it to the instructor while the quiz was still available for consideration.

Challenges reported by the students were primarily dealing with AutoCAD. Sometimes, when students were doing their assignments in University Computer Labs, the template being used, or the CAD buttons were not located in the same spot as the instructor's in the video. When the template was found, a pathway was posted on D2L in the news section. Sometimes certain commands were more problematic for students, even after watching the video multiple times extra help was necessary. The instructor was available during office hours, and additional tutoring times were set up for CAD through the College of Engineering, Architecture, and Technology Student Success Center. The free tutoring was available two times per week, and students could either bring their laptop or go to the computer lab with the tutor. The tutoring issue was suggested by the students through the informal CAD evaluations, and was immediately arranged.

Lessons Learned - Future Improvement

The course will be offered again in the Spring of 2009, and it will naturally be easier the second time. All of the quizzes for the Print Reading Lectures are already loaded into the system. All of the questions have been tested by the first group of students, and some were thrown out of the pool the first time due to ambiguity, or answers that did not work with the computerized format. The AutoCAD videos have already been recorded, but the plan is to record them again since the instructor is more familiar with the program. Also, the videos will be segmented to ease navigation. The *AutoCAD text – Residential Design Using AutoCAD* will be offered two ways at the bookstore, with a 180 day AutoCAD License and without. The Publisher offers this option for an additional cost of \$35.00, and it will help those students who would like to do all of their work at home. Students can also purchase AutoCAD LT for their home computer if desired. Tutoring hours will also be set up at the beginning of the semester to provide extra help for students.

Overall, teaching AutoCAD online was a success. An overwhelming majority of the class (88%) liked the virtual format for many different reasons. The most frequent response was that they enjoyed learning at their own pace. The instructor's objective of imparting introductory AutoCAD knowledge was definitely accomplished. By the end of the course, the students had drawn architectural symbols, floor plans for three levels of a house with windows and doors, elevations, a wall section, and inserted architectural symbols. By the formal evaluations at the end of the course, one can see that the students were happy with the overall course. Next spring will provide a new opportunity to get feedback and improve the course. In the future, it a comparison students who took AutoCAD online with students who took a traditional AutoCAD course would be another opportunity to assess the effectiveness of this model.

Other Camtasia Applications

Once the Camtasia program was mastered, the instructor formulated a number of additional uses for the program. Numerous class lectures have been recorded when the professor is away at conferences, competition, and presentations. Typically, the lecture is presented in a PowerPoint format, with the instructor's voice providing additional information. The students are expected to watch the video and take notes. This allows class to continue while the professor is away. It also allows the professor to record and post videos from her laptop while traveling.

Additionally, remembering that Camtasia was developed for software training, it could be used to teach the basics of scheduling software or project management software. Students have also requested using the program to teach computer estimating software like On Center and Timberline. Using an online format could open the possibility for different professors to upload various software tutorials that are related to the course; and as long as the program does not have significant updates, the lectures could be recorded once and used semester after semester. Camtasia, and other screen/voice/video capturing software provides flexibility for professors and students, by taking the traditional classroom to the virtual classroom.

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