SOFTWARE TOOLS FOR ONLINE TEACHING: A FACULTY PERSPECTIVE

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Abstract

Many engineering programs across the country are looking into online courses as a means of expanding their programs and broadening their student demographics. Inherent in online education is the use of computer software tools, but not all tools serve to support student learning and evaluation. This paper will discuss the software tools used by two faculty members who converted five different mechanical engineering courses, both undergraduate and graduate, into fully online courses. The focus will be on software tools used in material presentation, evaluation, and interaction. The discussion will include the reasoning behind the choice of these tools and both the pros and cons from the perspective of the authors, as experienced over four semesters of teaching online.

Background

Listed in Table 1 are a combination of undergraduate and graduate core courses taught completely online as part of the mechanical engineering program at The University of Texas at Tyler. The two faculty members involved had taught all courses previously as face-to-face classes.

Table 1. Online courses represented in this paper.

Semester	***Course***	***Instructor***	***Enrollment***
Fall 2012	Grad Core #1	B	13
	Grad Core #2	A	13
	UGrad Core #1	A	9
Spring 2013	Grad Core #3	B	14
Fall 2013	Grade Core #4	B	8
	UGrad Core #1	A	12
Spring 2014	Grad Core #1 + UGrad Tech Elective	A	16

All courses listed included both on-campus and off-campus students. The graduate courses were a mix of full-time graduate students and working professionals. In Spring 2014, the online course was a combined undergraduate technical elective and graduate core course, with additional course requirements included for the graduate students.

The learning management software package *Blackboard* was used to provide access to all course material, including lectures, videos, exams, assignments, and self-assessment.

Presenting the Course Material

Online courses, by their very nature, require a different approach to presenting the material. While some may view this as a hindrance, others see it as an opportunity to use methods that simply do not fit in a classroom setting.

The traditional lecture style delivery is still possible with online teaching by recording the lectures as they would be given in a classroom. *Camtasia* is one of many video editing packages that allow faculty to record narrated PowerPoint lectures and screen recordings [1]. It has also been used to record how-to videos for teaching students about software by recording both the screen and audio components, allowing faculty to develop their own instructional videos for applications ranging from using Excel for a certain type of problem to using the university library search engine [2]. Similar software packages are available that can achieve the same goal. Blevins and Elton compared *Camtasia* to two other programs in the creation of online database tutorial development and found that in terms of usability, accessibility, cost and time, *Camtasia* worked best for their application [3]. *Camtasia* advantages include its ability to produce a wide range of media types, suitability for long presentations, and ease of use with web cameras [4].

Another popular software package for producing online lectures and tutorials based on screen capture is *Adobe Captivate* [5]. *Captivate* offers a project library to allow users to quickly access previously used content and provides additional options for editing how-to videos based on screen captures [4].

Slide-sharing platforms are an alternate means of sharing lecture material with students. *SlideRocket*, for example, allows presentations to be imported from *PowerPoint* or *Google* (or created from scratch), narration can be recorded slide by slide, and easy sharing of the content [6]. One of the advantages of using a slide-sharing platform is the elimination of recorded videos and thus smaller download for the students. It also makes it very simple to update a single slide without having to re-record an entire lecture.

Presentation of example problems or derivations may require a different approach. The *LiveScribe* pen can combines digital capture of handwriting with audio narration at less cost than a tablet PC [7]. Moore *et. al.* describe its use as follows: “The smartpen technology works differently from other digital pens in that it records both the written word on the page and audio simultaneously, which can then be played back by tapping the handwritten marks on the page or saved as recordings that can be transferred to the computer as a viewable movie and played back.” [8] The recorded pen strokes and audio can be made available to the students in the form

of a pdf file. Engineering educators have used this technology successfully [18 – 19], and received positive feedback from students.

Graphics tablets or digital pens can also be integrated with screen capture software to record handwriting and audio. For example, Andres *et. al.* used a graphics tablet with *Windows Journal* and *Microsoft OneNote* and in connection with a thermal engineering class to facilitate working example problems, showing students how to interpret required tables, and correctly use charts and plots [9]. The notes can later be posted for student access, and the use of screen-capture software make this approach yet another attractive alternative for presenting lectures, examples, and derivations. One of the drawbacks, however, involves the difficulty that some faculty have in writing neatly on a graphics tablet. This is the same problem faced by those who opt for a touchscreen tablet such as the *Windows Surface Tablet*.

For faculty who are not tied to the traditional lecture approach, another alternative to the presentation of course material would be a package like *Softchalk.* This software package allows creation of interactive course content including self-assessment tools, compatibility with major learning management systems, a cloud-based storage system facilitating reusability, and access to repositories of learning tools such as quizzes, activities, and media [10].

For lectures, both authors used *Camtasia* for presenting narrated lectures and well as "how-to" videos for engineering software packages and some example problems. For some lectures, however, *SlideRocket* was used and made available to the students through an embedded link and direct link. All courses used *YouTube* videos to supplement the lecture material. Example problems and derivations were typically presented using files generated by the *LiveScribe* pen and example problems worked and recorded using *Camtasia*. The main learning curve was not so much in using the software but making the resulting lessons and videos available through the learning management system.

Evaluation of Student Learning

Distance education has been around long before the Internet, and exams were administered using proctors. A proctor oversees administration of the exam and is responsible for preventing academic dishonesty. The proctored approach to exams for distance education is still applicable today. The first step is for the student to submit a proctor request form to the instructor. Suitable proctors can range from a staff member where the student works to a testing center at a local college, but the instructor has the authority to reject a proctor who is deemed unsuitable. The exam will be provided to the proctor with instructions for its administration. The student must work with the proctor to setup a suitable time to take the exam. The instructor provides a limited time window in which the exam must be taken, so both the student and proctor must work together to schedule an appropriate time. The proctor administers the exam after verifying the student's identity, oversees the exam to verify that no unauthorized sources are being used, collects the exam after the allotted time has passed, and returns the completed exam to the faculty member.

A more modern approach to proctored exams is the use of technology such as *ProctorU* [11]*l, Kryterion* [12] and *RemoteProctor NOW* [13]which provide online proctoring of exams through the use of webcams. This approach is similar to having a professor watching a classroom full of students during an exam, including verification of their identity [14]. Because the proctoring is done by webcam, the exam can be recorded and later checked for inappropriate behavior or proctored live. There is also better verification of identity using biometrics or typing rhythms [15]. Limitations of services such as this include paper exams, because it is difficult for the web-based proctors to see if they are cheating when their eyes leave the computer screen to work on their paper.

One of the major benefits to this approach include the ability to give online students the same type of exam as would be given in face-to-face classes. Issues that can arise from this approach include attempts to request an inappropriate proctor, failure to correctly schedule their exam time with the proctors, and failure to submit a proctor request form to the instructor. In addition, proctoring can be expensive for the students.

Another alternative in online proctoring services is fully online exams. Exam content is not limited to conceptual questions because many learning management systems support the creation of questions whose answers must be calculated. In addition, problems can be presented to students who then upload their solutions to the learning management system. The faculty member has control of when the exam is taken, how much time is allotted, and how the questions are presented. *Respondus Lockdown Browser* is one of the tools available to prevent students from accessing unauthorized web resources during an online exam [16], and similar tools are available in many learning management systems.

Even with online exams, there are still issues of academic dishonesty. Online proctoring services such as those already discussed are one potential solution. Another solution is to implement additional exam policies. Cluskey *et. al.* developed eight essential "Online Exam Control Procedures" [17]:

1. Offer the exam at only one time
2. Limit the time window that students have to log into the exam
3. Randomize the order of test questions
4. Present the questions only one at a time
5. Design the exam to take the allotted time
6. Only allow the students to access the exam one time
7. Use a lockdown browser that does not allow students to open any other tabs while taking the exam
8. Rotate exam questions so that they are not the same in consecutive semesters

Some instructors may opt for open-book exams. Students are given an exam (usually a set of time-intensive problems) and have a limited time to complete the exam. They are given access to any and all resources except their classmates. Development of an effective open-book exam such as this is time consuming, and it does not prevent academic dishonesty.

The authors took different approaches to evaluation in their online courses. Two examples will be provided. One of the undergraduate core courses had local area on-campus and off-campus students enrolled. The first two exams were online, and required the students to upload their answers to traditional "fill in the solution" problems to Blackboard. The students had a 24 hour window in which to take the exam, and had one hour to complete it once they logged in. Students were caught using the textbook solution manual. After that instance of academic dishonesty, the remaining exams for the on-campus students were administered in a classroom by the instructor.

In one of the core graduate course, a take-home exam was accompanied by a fully online conceptual exam with a 30 minute time limit. The instructor intended for the time limit to discourage the students from accessing offline or online resources. One student was unable to download the software on his work computer because of company policy. One student expressed worry that he would not be able to complete the timed portion of the exam, while another student expressly stated that he ran out of time to complete the exam. From a faculty perspective, there was a learning curve involved in creating the online exam correctly and setting it up for use with *Respondus*.

Interaction between Students and Faculty

One of the greatest differences between teaching an online class as opposed to a face-to-face class lies in how we interact with the students. The instructor cannot look for visual indicators of confusion, there is not opportunity to read body language, and no way of judging tone of voice. The only means of communication for a fully online course is electronic: learning management systems, email, chat, or telephone.

Both research and common sense indicate that interaction between the student and the instructor is critical for a successful online course. Many students automatically assume that the communication is more difficult because the course is online [18], and are not comfortable seeking help from an instructor unless it can be done face-to-face. Students used to quick feedback in class or during office hours will tend to get frustrated waiting for faculty to respond to a question posed via email [19]. Research has also shown that it is the responsibility of the instructor to take a pro-active role in communicating with the students [19].

Faculty members should start by being as clear as possible when giving instructions. In his book on online course design, Smith identified five key considerations for online faculty [20]:

1. Provide detailed instructions and do not skip steps
2. Be proactive by emailing students regularly during the duration of the course
3. Tell students what the expected response time will be for email
4. Define times when you will be available for immediate email responses
5. Self-assessment tools will help students determine more quickly when they need to seek assistance

Shackelford and Maxwell report that students value having more than one means of communicating with the instructor, including both personal communication and public

communication (*e.g.*, discussion boards) [21]. This could include email, chat, telephone, and teleconferences for synchronous discussion and discussion boards for asynchronous communication.

There are free online teleconferencing tools available such as *WebEx* [22]. These applications allow multiple users to sign in, share their desktops, exchange files, and give presentations. They typically support webcams and/or microphones, and at additional cost can allow users to use a long-distance telephone number instead of a computer microphone. These online meetings can be recorded and made available to others. The drawback for many online students is that their schedule may not allow them to attend.

For one-on-one communication with instructors, free tools such as *Skype* [23] and *ooVoo* [24] can be adapted to allow the student and instructor to communicate using webcams, giving a sense of face-to-face personal interaction that is missing from email and chat.

The classes presented in this paper primarily used asynchronous communication in the form of email, with an occasional telephone call from a student. As discussed by Powell, the authors found out that communication with the students typically required the instructor to take the first step [19]. A simple email sent out the class inquiring into their progress on homework can uncover misunderstood concepts and questions waiting to be asked.

Conclusions

Navigating the software tools available to faculty today can be a daunting task, but the first step is to remember that the goal of online teaching is not to fall for the latest technological fads, but select the tools that will best support your class. It is still possible for faculty to keep the same lecture-based format for classes as they go online, but we should be willing to adopt tools that will better serve our teaching goals and adapt our methods to better serve our online students.

From a faculty perspective, slide-based lecture presentation with audio narration or video recording worked well for presenting the bulk of the material, but care should be taken to keep the videos under fifteen minutes so that students will not have excessive difficulty in downloading them. Example problems and complex derivations, however, still need that “live” feel to them to keep student attention and encourage them to follow along. This makes handwriting and audio capture the preferred method of presentation. Exams will always run the risk of academic dishonesty, and proctored exams, whether proctored online or face-to-face, still seem to be the best approach from the author’s experience. Interaction with students remains a key factor in any online course, and while email and telephone have served well up to this time, consideration should be given to a more face-to-face approach using one of the many free online tools.

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