

AC 2009-938: CONVERTING FACE-TO-FACE CLASSES TO WEB-BASED ON-LINE COLLEGE CLASSES

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Converting Face-to-Face Classes to Web-Based On-Line College Classes

Abstract

Due to the increasing interest in web-based college courses, some engineering and engineering technology departments are exploring the idea of converting traditional face-to-face college classes into on-line courses. The Manufacturing Engineering Technology Program at Minnesota State University, Mankato MN, has put most of our Industrial Engineering-based senior-level courses on-line via the web over the past few years, converting these classes from traditional face-to-face campus lectures and laboratories.

We have learned quite a bit in the process. Web-based, on-line classes provide advantages for students who are remote or have schedule problems, but there are a number of factors and costs, often hidden, which also must be considered when converting traditional classes to on-line classes. This paper will present case-study examples of class conversions of two Industrial Engineering-based classes (Logistics, and Industrial Safety) which are taught as part of the Manufacturing Engineering Technology program. We will discuss preliminary evaluations of results, and will present a few of the advantages, costs, and problems involved with teaching these on-line courses. We will also discuss the experiences of a newly-hired faculty member who is teaching an already-converted on-line Industrial Engineering-based class for the first time. This paper will be valuable for programs considering developing on-line classes, especially in the areas of Industrial Engineering and Manufacturing.

Advantages – Why the Classes were Offered On-Line

With the growth of the internet and supporting programs, many institutions of higher learning are examining the possibility of offering at least some classes over the internet. While correspondence courses by mail have been offered for many decades, the immediate response and information bandwidth of the internet offer the possibility of real-time remote interaction, electronic homework and exams, and instant streaming video and audio not available by mail. With proper support, web-based instruction computer programs such as Desire2Learn (D2L)¹, a commercial classroom management system (similar to Blackboard, etc.), allows remote students to password-access materials on their own schedule while requiring online discussions at specified times, at the instructor's discretion. Thus, web-based, on-line college classes offer the opportunity to teach classes to a much wider audience of students with schedule flexibility. But nothing is perfect.

The Minnesota State University, Mankato's Manufacturing Engineering Technology program culminates with our students completing a two-semester Senior Design Project, often at out-of-town manufacturing facilities. These students must travel between the sponsoring company and our campus almost daily in order to do their design project while also taking face-to-face classes here. In addition, we are working with remote community college partners to develop articulation agreements to allow students to take the first two years at a local community college, and then transfer to our university to complete their four-year Bachelor's of Science degree in

Manufacturing Engineering Technology. At least some web-based courses would mean that these students would not need to spend as much time away from their homes, which could attract more students.

Thus it made sense to consider putting the senior classes on-line to allow these students to work from a remote location. We did not have the resources to offer the same classes face-to-face and also on-line; it was determined to be too costly to offer both methods simultaneously. There are not enough students in the program to offer most classes more often than once per year, so it was decided to convert all the traditional senior classroom classes almost completely to an on-line format, with each class requiring only a single on-campus face-to-face meeting.

Converting Traditional Face-to-Face Classes to Web-Based On-Line Classes

The first step in putting classes on-line was to decide which classes would be converted to on-line over the web. By the time our Manufacturing Engineering Technology students finish their junior year, they have had most of our hands-on engineering and laboratory-based courses. We had six traditional Industrial Engineering-based face-to-face classes in the senior year: Manufacturing Resource Planning and Control, Ergonomics and Work Measurement, Industrial Safety, Project and Value Management, Logistics and Transportation, and Quality Management Systems. There was a total of nineteen credits for these courses; with the three Senior Design credits, the total came to twenty-two MET credits for the senior year. When we put these courses on-line, students had the choice of taking other courses on campus, or taking a number of on-line course offerings from other departments, in order to complete their normal load of thirty-two credits for the year, or they could choose to take a reduced load during their senior year.

The second step was to decide how we would use the single two to three hour, on-campus, face-to-face meeting. Of these senior classes, only the Ergonomics and Work Measurement class had a significant laboratory component. When put on-line, this class would condense all laboratory experiences into the single on-campus meeting. The remainder of the classes generally would use the single on-campus meeting for presentations of student projects, for discussions, and for the final exams. We used the Desire 2 Learn (D2L)¹ system of web-based instruction, which is relatively easy for the instructor to use with the program's ability to edit and add content, upload files, link to net sites, assemble and grade quizzes, collect e-homework, hold discussions, and determine grades. The linking ability made it possible to link to the University's streaming server to provide videos of lectures and professional videotapes and DVDs (with proper license agreements to use copyrighted materials, of course)².

Next, we decided to convert the classes in a phased manner, rather than all at once. The Chair of the Department of Automotive and Manufacturing Engineering, Ann Goebel, took the lead in converting Manufacturing Resource Planning and Control, Ergonomics and Work Measurement, Project and Value Management, and Quality Management Systems to on-line courses. The learning curve was steep, as our department had never put courses on-line before. By the time we converted the last two courses, the process had been streamlined. For this reason, this paper will concentrate on these last two courses, along with the introduction of new instructors into existing on-line courses.

Steps Taken to Convert Existing Face-to-Face Classes to Web-Based On-Line Classes

The year before conversion, while converting the first four courses to on-line, we also video recorded the in-class face-to-face lectures for Logistics and Transportation, and for Industrial Safety, to simplify the next year's conversion of these two classes. During this time, any assignments requiring face-to-face interactions were modified to make them work on-line. The results were then edited so they could be streamed over the web the following year.

To make the classes ready for the web, handouts were scanned so students could download them, and some PowerPoint presentations were uploaded into D2L. The entire class schedule was then broken down into one-week modules. One class, safety, originally had few, on-line, weekly work assignments, but we quickly discovered that students often put off their work too long. So the class was revised to add a weekly quiz in each module, which improved class participation. Quizzes and grading information were uploaded, and the time of opening and closing each portion of the class was set. We found that D2L makes the editing process quite easy, and are currently using the same program and methods to enhance our face-to-face classes also.

We quickly learned that these procedures took much more time than it took to prepare for a traditional face-to-face lecture class. Unlike simply inserting, playing, and showing a purchased video in class, each video used on-line requires a license to stream on the web, and then the video must be converted and uploaded. While an instructor thinks little of simply showing illustrations and pictures on a document camera during lecture, there are copyright issues when scanning material for placement on the web. Even under the "Fair Use" doctrine, the United States Copyright Office warns, "The safest course is always to get permission from the copyright owner before using copyrighted material. The Copyright Office cannot give this permission. When it is impracticable to obtain permission, use of copyrighted material should be avoided unless the doctrine of 'fair use' would clearly apply to the situation. The Copyright Office can neither determine if a certain use may be considered 'fair' nor advise on possible copyright violations. If there is any doubt, it is advisable to consult an attorney."² Compounding this issue, it is possible for students to capture and redistribute content, even though D2L requires password access. This is more of a problem if complete Quicktime files are uploaded, but even streaming video is not completely safe from copyright infringement. Sometimes it is easier to design and compose entirely new illustrations and graphs (which must not be derivatives or copies) rather than take the time and effort to get licenses or legal reviews of each illustration. Or simply eliminate that visual aid for web-based classes to avoid potential legal problems.

Our experience has been that sometimes students see materials a bit differently on their computers from what instructors see, so each lesson should be previewed as a student before release. WORD and EXCEL files saved in 2007 format cannot be viewed by students with earlier versions. Quizzes must be reviewed for release times, conditions, and retakes, and for the reports sent to students when quizzes are completed. We found out that, due to an error on our part, some students were getting printable reviews of their quizzes with correct answers before others had even taken the quizzes. Even videotaped lectures must be reviewed and often edited – remember, any mistakes made can be kept by savvy students and repeated for perpetuity, or uploaded on-line for everyone to see, so it is unwise to simply release material on-line without

review. We estimate from our experience that it takes four to ten hours to properly and legally prepare and administer each quality hour of new web presentation!

New Problems and Costs

The D2L system loaded the students' information into the classes, set up the grade book, and we were ready to go! Or so we thought. New problems which did not affect traditional classes surfaced right away.

There were technology issues. Some students did not have the correct computers or know how to use them, so we became technicians in addition to teaching. Or the net would go down just as students were using it (or so students claimed while asking for extensions of time). But that happened to us, also, so we were kind. Quiz grades sometimes were not recorded (usually student error).

There were pedagogical issues. We had problems opening student submissions. Each submission takes time to open, grade, and make available to students for review. Without classroom interactions, we sometimes answered the same questions via telephone and e-mail multiple times, because University privacy rules prohibit broadcasting private e-mail questions to all students in some cases (so we answered all inquiries individually). New material added from one semester to the next requires significant setup time and editing to present, while it can be easily added to face-to-face lectures.

Security was an issue. There was no reasonable easy way to proctor exams or quizzes, except during the single face-to-face meeting. While local institutions and libraries might offer proctoring services, setting these up, distributing exams and quizzes, and retrieving them in a secure fashion takes time and money which the program might not be able to afford. Without proctoring, there is no way to ensure that students are not sharing information, using illegal resources, or participating in "quiz teams" where one of four or five students takes the exam while the others watch (rotating from quiz to quiz).

In fairness, grading of quizzes and exams is easier and less time-consuming, even though it takes more time to prepare the questions. And the second semester's presentation can use much of the previous semester's material. But even these advantages require some caution. Some students can print out or at least let others view the quizzes before others have completed them (see the "quiz teams" above). Also, there is temptation to reuse too much old material, because of the great investment of time and resources to update classes. Copyright licenses must be kept current. Previous courses should not simply be recycled. Quality can suffer without vigilance.

Demands on instructor time were significantly greater. These demands included time to film and edit presentations, studio scheduling & access time, significant time for technical training, and file conversion time. Quality of videos is a major issue in web-based instruction.³ As stated elsewhere in this paper, additional time and budget were required for editing and verifying web instruction, maintaining copyright and license issues, login and downloading student homework and discussions, answering questions multiple times, handling technical problems, and preparing additional slides and scanned materials. And, because our University has a Union Contract which

does not allow for fair payment for this extra time, many of the extra hours required from instructors were often provided on unpaid weekends. Another hidden cost to the university is the support staff time required to maintain and correct equipment or program failures and incompatibilities.

Equipment costs included University studio equipment, servers and storage devices, local computers, computer cameras, green screens, and other materials. Fortunately, most of these were available here with good staff backup, but departments contemplating new on-line classes should make sure that the support is available, or else each department will need to provide this at their own cost.

While the two obvious costs were time and equipment required, other issues included the difficulty of obtaining and maintaining many licenses for copyrights and other intellectual property. We found that it was more difficult to guarantee exam and homework integrity, especially if remote proctors are involved. Laboratories and student presentations had to be combined into the single face-to-face meeting (or eliminated). Other problems which surfaced included the lack of interactive contact with students, poor scheduling on the part of some students, equipment and program incompatibility required attention, system reliability required emergency attention when quizzes were closing, and we had a few problems scheduling rooms for the single face-to-face meeting.

Changing Instructors of On-Line Web-Based Classes

When new instructors took over existing on-line classes, two new problems emerged. The first, and most obvious, was that the new instructor must replace the old in lectures and videos, and also in all references, notes, e-mail addresses, and everything else. This means that much of the course material is new, and little can be re-used. The second problem is that virtually all previous course material has automatically been copyrighted under the former instructor, and cannot be legally used without license or release signed by that instructor! The United States Copyright Office states, “**What is copyright?** Copyright is a form of protection grounded in the U.S. Constitution and granted by law for original works of authorship fixed in a tangible medium of expression. Copyright covers both published and unpublished works. **What does copyright protect?** Copyright, a form of intellectual property law, protects original works of authorship including literary, dramatic, musical, and artistic works, such as poetry, novels, movies, songs, computer software, and architecture. Copyright does not protect facts, ideas, systems, or methods of operation, although it may protect the way these things are expressed.”²

The new instructor of the Industrial Safety course learned of this copyright problem less than two weeks before the course was scheduled to start. The Power Points were purchased from the previous instructor by Minnesota State University, but the remainder of the entire course was required to be prepared as a brand new course. The new instructor purchased his own Apple computer in order to accomplish this, and discovered that a combination of short video clips of lecture could be edited in combination with narrated Keynote (Power Point) slides to produce Quicktime lectures that were far superior to the old video taped lectures! The slides were much clearer, students could pause and review them and re-listen to the explanations, and the videos of the instructor were much better lighted as well. But the editing together and compilation took extra time, and most weekends were consumed in simply getting the material on line no more than a few days late.

The new instructor of two other classes had similar experiences, except that he did not purchase his own personal Apple computer, but chose to use University facilities. Thus studio scheduling problems loomed even larger. The bottom line lesson is that older on-line web-based classes with new instructors require almost as much preparation time as a new class.

Evaluation of Results and Why We Returned to Traditional Face-to Face Classes

We evaluated the results after a few years of offering on-line classes, and decided that these classes were not cost-effective enough in terms of time and money to justify continuance. There are three main tools to compare the effectiveness of the two methods of presentation: comparing grades, using student evaluations, and comparing assessment instruments such as homework and final exams. We did not do a formal statistical experiment to compare student learning outcomes using assessment instruments, because most classes were only offered once per year, we had too small a sample of students each year, and past data (except for final grades) was not always available. So we relied on grade comparisons and student evaluations to compare outcomes.

Many students indicated a preference for traditional classes, although some liked the ability to repeat lectures multiple times. As a test, some instructors embedded a few easy extra credit points in the on-line lectures, and found that too many students missed these. This suggested that some students did not always pay attention, or even fast-forwarded through the presentations. Grade distribution was similar between face-to-face classes and on-line classes, except for a few students who did worse with the on-line classes, bringing the overall average down. Enthusiasm was harder to generate on-line. Less laboratory experience and less student interaction are thought to be some of the reasons some students' grades were not as good.

But some students reported that the on-line classes were easier to complete, because parts could be repeated, and because they were comfortable with the technology. This can especially help students with certain disabilities (but this may require significant changes in the course).⁴ Finally, a few students said that the ability to take on-line classes remotely made it possible for them to graduate on schedule.

But most students who took the classes on-line were close enough that they could meet on campus. In fact, many of these students were on campus to take other classes. Budgets are tight, and course loads have been increasing. Thus we cannot grant the additional release time needed to adequately prepare the on-line classes. Because we cannot justify added time or dollar costs at this time, we made the decision to change the on-line classes back to traditional face-to-face classes. But we learned many lessons, and would consider placing at least some of our classes on-line again if conditions change sufficiently and adequate resources are available.

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