Workflow for developing online content for hybrid classes

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Workflow for the development of online content for a hybrid learning course

Introduction

Hybrid learning, or blended learning (an alternative terminology with similar meaning), is intended to combine the best features from a traditional face-to-face learning environment with the added benefits that can be obtained by using a technology-based learning environment [1]. Typically hybrid learning courses include e-learning activities such as online lectures, online quizzes, synchronous or asynchronous discussions, and group work sessions [3]. Hybrid learning is an emerging concept which, when executed correctly, has been proven to increase efficiency for the institution and learning for the students [2]. An early hybrid learning course that was developed at a large Midwestern university consists of face-to-face interaction as well as online problem solving demonstration modules and lecture videos. The two components, face-to-face interaction and online, must be synchronized and the content for each must be carefully planned in order for the course to be successful. There is considerable research as well as trial and error development effort that must be invested to develop both components of a hybrid learning course. However, in this paper, the development of the online component will be discussed.

In particular, this paper discusses the pilot implementation of the online component for hybrid learning in three construction engineering classes. The primary target of the effort was ConE 322 Construction Equipment and Heavy Construction Methods. This is a three credit junior level course that originally included two lectures hours and a calculation lab that lasted two hours each week. The objective was to replace the face to face passive content of the lectures with online content and use some of the time released for interactive activities. The laboratory periods consisted of interactive group work, so little change was contemplated for that portion of the class. In addition, online content has been developed for ConE 441 Construction Planning and Scheduling and ConE 421 Construction Cost Estimating.

The task of developing an online component is a detailed and iterative process to perfect. As previously mentioned, the online component of the hybrid learning courses that are documented in this study consists of online modules and lecture videos. The online modules are interactive activities that demonstrate problem solutions and allow students to practice solving similar problems in a step by step interactive, scaffolded learning environment. The problem

demonstrations are chunked with a series of questions that are inserted between the chunks that gauge student comprehension of the key points. Student performance in this step by step learning environment is augmented with explanatory feedback. Each module is a stand-alone unit that can be used as preparation for face-to-face sessions after the student has completed related readings from the text book. The modules are used to prepare students for solving open-ended questions in these face-to-face settings. The modules also serve as a tool to prepare students for independent problem solving (solving problems that have definitive answers that are not broken up into steps) in class and online. The use of online modules was expected to replace classroom time where example problems are solved by the instructor.

The online lecture videos are straight forward in concept in comparison to the online modules. Lectures that were normally given in a face-to-face classroom format by the instructor are made into online videos that are chunked with multiple choice questions inserted between the chunks. Many times, lectures that are given in class are merely a transfer of knowledge; there is little interaction that is crucial to the student's learning. Those types of lectures are good fit for online lecture videos and allow the students to obtain the information that they need online outside of classroom time. This, in turn, frees up face-to-face classroom time that can be used to apply the knowledge obtained through the lecture.

Throughout the rest of this paper, the detailed process for developing the online component of a hybrid learning course will be described and discussed. Throughout this paper these words *step* and *process* are used interchangeably. The investment it takes to successfully complete this process and problems that were encountered along the way are also discussed below.

Developing the Online Component

Several steps are required to develop the online component of a hybrid learning course. Various tools are needed along the way and the right team needs to be put into place. In the effort described in this paper the tools and the teams were selected by conducting research to find a likely initial solution and making adjustments in order to overcome unexpected challenges. The purpose of the following discussion is to provide others with a framework on which to build.

The overall workflow is broken down into three main phases: analysis and design, development, and evaluation. The analysis phase consists of six steps. The first step is to ensure that the content covered in the online material is able to be directly linked to the grading system or

learning management system being used. The second step is for the instructor and the instructional design professional to discuss the best way to incorporate hybrid learning in the class. In the third step, *data collection*, the course material that should be covered in the online lecture videos and/or modules is collected from the instructor. Then in the fourth step the decision is made as to whether the material should be developed into an online lecture or an online module. Step five, *develop Lectora Templates,* is a step that is very specific to the process that was used in this project. Lectora is the interactive software that was used to implement the online modules and lecture videos. The sixth and final step of the analysis phase is to *train students to implement design.* If this is the first iteration of a hybrid learning development process for a development group, the Instruction Design Assistants (typically undergraduate students; a more in depth description of the team is given later) will need to be trained on how to implement the design. Important items to be considered during training are a review of the course content and goals; and instruction on the software and any other tools that are in use.

The second phase of the workflow consists of the steps taken to perform the actual development of the online components of a hybrid learning course. The two main steps in this phase are *develop lecture videos* and *develop online modules.* Each of these steps has their own sub-processes that are required to successfully develop each type of online component. A major portion of the steps in the sub process involves direct use of the software and many other technological tools.

The evaluation phase consists of extensive review and revision of the completed lecture videos and modules. The online materials are considered complete and ready for implementation, but even though they are implemented into the course, the process is not complete. Once the students enrolled in the course have used the online material for the first time, there needs to be a further investigation to determine how effective the material was and if anything needs to be changed. In reality, the online material is never fully complete, because updates and changes should be made each and every time the material is used in order to keep it up to date.

Findings

It was found that the overall process requires considerable staff time and attention to detail, as well as expertise in various areas by various team members. Further details will follow including

a description of the type of team members, tools, time and financial investments required. This information is intended to help other institutions make improved predictions regarding the investment required to develop a hybrid learning course.

The Team

Five team members were needed to develop the online component of a hybrid learning course addressed in this paper. The first team member is the course instructor. The course instructor's responsibilities are to give insight to the instructional design professional on the goals of the course and how they may want hybrid learning to be incorporated into the class. An instructor is also responsible for providing the material to be used for the online component and can help review the developed content.

The second team member is the instructional design professional. This person has the most responsibility as s/he will be in charge of coordinating the entire hybrid learning course development for all classes. S/he will manage instructional design assistants and provide direction for the entire team on how the plan will be executed. They must be sufficiently knowledgeable of all the software and tools used in the process to train other members of the team on how to use them. The instructional design professional is the nucleus and the driver of the entire hybrid learning team.

The third team member is the graduate assistant/content expert. This member of the team, as the name suggests, preferably will be a graduate student who has taken the course being transformed into a hybrid learning course. It also is very helpful if the graduate student is a teaching assistant for the class as well. The graduate student can be a valuable resource for reviewing content accuracy and ensuring that it meets the goals of the course. If the graduate student is the teaching assistant for the course, he or she can play a major role in helping to organize course reviewers (to be explained later) as well as implementing the hybrid learning materials into the class.

The fourth team member is (are) the instructional design assistant(s). This team member or these members are managed directly by the instructional design professional and are responsible for developing the online lecture videos and modules. The authors' experience is that it works well to hire undergraduate students who have taken the course as part-time employees for this position. Such students will likely have valuable input on how the online material should be

developed and presented. The instructional design assistants will need to be motivated and intelligent students as they will be expected to learn new software and other tools. They will be doing much of their work on their own time, so being able to meet deadlines and being self-motivated essential requirements for such positions.

The final team members are the course reviewers. Any student taking the course can become a course reviewer. In the study done for this paper, the students who participated in the reviews received extra credit in the class. Having a wide variety of these team members is desirable, because it is important to make sure that the online course material is a fit for various learning styles and complements the rest of the class activities.

The Tools

The software applications that are used for developing the lecture videos mainly include Camtasia Studio 8, Snagit, and Lectora Inspire. Camtasia Studio 8 is a software application developed by the TechSmith Corporation. It is designed so that it can be used by non-professionals and is relatively easy to learn. It is often used to perform screen recordings and edit videos. Under the development process described in this paper, the Camtasia software application would be the primary tool for preparation work in developing lecture videos. The editing function allows users to cut a full pre-recorded lecture video into sections or chunks. On this project typical chunks, are three to four minutes long. The software can also separate the video from the audio so that they can be edited separately in order to remove unwanted images or sounds.

Another helpful software application tool is Snagit. This tool has two major functions: capturing and editing. The capture function can capture videos, images, and text. The Snagit Editor function can also help with basic tasks such as removing a background or stacking images together. In conjunction with Snagit, the Camtasia software is able to add text, animations, callouts, and even hotspots to the video. During the process of cleaning up and developing a lecture video, the file is exported out from Camtasia by “Produce and Share”. Camtasia allows the user to publish the video into many different formats. In this study, the files were exported in MP4 format because it is compatible with the interactive software (Lectora) as well as many types of web browsers. Once lecture videos are completed, the files are input into a lecture template. Once the file has been input in Lectora and the file is ready for publishing, it will be

uploaded to a learning management system as SCORM file. Exporting it as a SCORM file allows the file to interact with the learning management system and ultimately allows the file to be scored and counted as grade.

The tools used for developing online modules are the same as those used for lecture videos. The first step in creating a module is to create problem statements and feedback scenarios based on the course materials. The problem statements and feedback scenarios are well-defined problems that the students solve that reflect the material being taught in the class. The reason there are multiple scenarios is because Lectora has function that will generate random scenarios. This is effective for the online modules because each student will have a different scenario of a given problem. The tools used for this step can be very basic. In this study the information was kept in a word file or excel file. After the information is developed in Word or Excel, it is important that it is reviewed for accuracy. Once it has been reviewed, the document can he transferred to the Lectora module template.

One component of the online modules is the How-To videos. The How-To videos can be thought of as shortened lecture videos that help to explain the problem that is being solved. In order to create How-To videos, it is necessary to record a narrative, and then turn the narrative into a video. This is done using Camtasia through a process that is similar to the one described above for lecture videos. The How-To videos will typically have more visual solutions added to the video to help better illustrate and explain the problem scenario. These visual solutions are typically obtained from textbooks or from websites. Once the file has been completed in Camtasia, the file will be exported as a Web HTML file. From there, it will serve as input for a Lectora module template.

Three new tools were introduced is the preceding paragraphs; Camtasia, SnagIt, and Lectora. These tools were chosen to be used for this project, but equivalent software applications could also be used. Most of the tools currently being used are very user friendly and are easy for new students to learn.

The Time Investment

Transformation of the course addressed in this paper commenced in the summer of 2012. It has been approximately 18 months since then and the course will be fully complete in a month. It

should be noted that the course that has been developed has every lecture online and nearly every typical lab assignment online; not all courses will be able to do this. Considerable time was invested in startup activities such as learning the software, developing procedures, troubleshooting difficult processes and developing templates that can be reused in the future. Many of these time consuming activities are one time investments that do not need to be repeated. In addition, time was also invested in developing six modules for use in other courses. Knowing the time commitment to build the course just described and the experience the current team has had with providing modules for other courses with less online content, it is safe to say 18 months is the maximum amount time needed to provide the necessary online content for a hybrid learning course, and the minimum would be 6-8 months. These estimated durations are based on the time commitment of the team members described above. Table 1 displays the number of hours each team member commits weekly. However, it needs to be pointed that the hours required for the instructor may vary depending on the instructor. Some instructors may want to be more involved in the development. If this is the case, the number of hours required will increase as the estimate above is based on an instructor who had little involvement outside of providing material.

Table 1 Time commitment for each team member

Team Member	Main Responsibilities	Hours
Instructor	Confirm accuracy of content, plan for the next step; ensure goals are achieved; provide the team with material	2-5 hours per week
Instructional design professional	Coordinate the entire hybrid learning course development; manage instructional design assistants; and provide direction for how the plan will be executed	40 hours per week
Content expert	Review the materials; confirm accuracy; provide materials	5-10 hours per week
Instructional design assistants	Collect and organize materials; edit and develop lectures and modules; develop questions an how-to videos; review and modify the final product	10 hours per week
Student reviewers	Watch the online lectures and modules, take assessments, and provide feedback	2-3 hours per week

The instructional design assistants, along with the instructional design professional had the most time commitment of anyone on the team. The first phase in which these assistants are involved, is the data collection and organization phase. The instructional design assistant needs to meet with the instructor to decide the best way to present the content, which requires 2 to 3 hours. The assistant should obtain all the data and materials, which may include audio, video, and power point files as well as questions.

After the material is collected and organized, the next phase is developing the lectures and modules. Table 2 displays the time commitment for instructional design assistants to develop lectures. A typical lecture video is 35 to 40 minutes long. It will be edited to 8 to 10 small chunks that are divided amongst the major topics, and each topic will have a corresponding question. Visual aids will be added to the video if necessary. Editing for the lecture videos typically requires 4 to 5 hours. Question development will require approximately 1 hour depending on the difficulty of the lecture and the developer's understanding of the material. Chunked videos and questions need to be reviewed before input to the Lectora template. The review process typically takes approximately 1 hour. Inputting files into the Lectora template typically requires 2 hours. The time commitment may vary depending on the developer's familiarity to the Lectora. Secondary reviewing, publishing, and testing on the learning management system requires 2 to 3 hours. Debugging (if necessary) can require 1 to 2 hours.

Table 2: Lecture Video Time Commitment for Instructional Design Assistants

Steps	Hours
Edit Video	4
Develop Question	1
1st Review	1
Input Lectora	2
Publish, test, review	2
Debugging	1
Total	**11**

Time investment for the modules is much larger than the lectures. This is because, for the modules, the developers must establish 5 to 10 different scenarios based on one problem and create detailed feedback for each question. This requires the developer to have a robust understanding of the class material and have the ability to be detail oriented. Table 3 displays the time commitment for instructional design students to develop modules.

Typically, a module that consists of 10 to 15 different questions will require approximately 4 to 6 hours in order to create a problem statement, provide a feedback mechanism, and also go through the review process. For each question, the developer will build a how-to video for the explanation. Writing the how-to video script and recording the audio file will take 3 to 4 hours. Generally, an explanation video for each question is about 1 to 3 minutes. Typically for every 2 minutes of how-to video developed, there is approximately 1 hour of time commitment by the developer. So, for a typical module, making the explanation videos will require approximately 10 hours for development, 1 hour for review, and 1 hour for modification, if necessary.

Making the explanation video is very time-consuming process, because the only class material with which developer has to work is the problem statement provided by the instructor. The most efficient way to develop the explanation videos is to have the instructor record all explanation as one video/audio file and then chunk the file into the number of steps required. This can reduce required development time considerably.

After all the problem statements, feedback, and videos have been created, the developer can put all the material into Lectora. The data input process takes 2 to 3 hours, based on the type of problem (multiple choice, true false, or fill in blank). It will take 1 hour for the module review, and another hour for modification. After that, the developer will publish the module to the learning management system for testing, which can take up to 3 hours.

For the study described in this paper, the developers were all full-time undergraduate students. Generally, for an individual who is able to only commit 10 hours per week to module or lecture video development, it will take one individual student 1 week to develop a lecture, and about two and half weeks to develop a module. Tables 1 and 2 summarize the hours described above.

Table 3: Module Time Commitment for Instructional Design Assistants

Module Development			
Steps	Hours	Alternate Steps	Hours
Problem Statement, Feedbacks	5	N/A	5
Write How-To Video Script	4	Obtain Video from Lecturer, then edit it	1
Record Audio File	1		
Make How-To Video	10		
Video Review	1		
Input Lectora	3	N/A	3
Publish, test, review	2	N/A	2
Debugging	1	N/A	1
Total	**27**	**Total**	**12**

Discussion and Conclusions

This detailed process indicates that developing online materials for a hybrid course requires a considerable time and human resource investment initially. Once the online portion has been initially developed; however, updating and maintaining requires considerably less effort. Because the team has created a workable template, going back and editing materials is a matter of re-publishing materials. Also, because the grades are scored in the course management system, the content needs to be published every semester. This requires someone to go back to the Lectora files and updating the current course ID number from the course management system and publishing the content again. Although this is not a very complicated task, the instructor needs to be familiar with the process if the instructional designer assistants will no longer be available in the future. An alternative solution could be to separate the assessment process from the lecture component and to develop online assessments within the course management systems. In this case, the videos will probably need to be hosted on a media streaming server (e.g. YouTube, Screencast, etc.) with links embedded to the course management system.

Spring 2014 was the fourth semester that the hybrid course format was implemented in Construction Equipment and Heavy Construction Methods course. Preliminary evaluation data indicated that hybrid course model has several positive features as they allow one-on-one learning at students' own pace; facilitate cognitive processing of the information; promote engagement with the material; address different learning styles; and allow flexibility of interacting with the material (See Koehler, et. al., 2013 for more details about the formative evaluation results). Anecdotal data from the instructor indicated that hybrid model contributed to student learning as the average exam grades were at least as good as previous semesters when the course was taught in a traditional format.

As with many pilot projects, there are many challenges encountered during the development of the course described in this paper. Many of the problems are either technological or developmental issues. Many of the technological issues are web browser issues. A goal for a hybrid learning course is to give students the advantage of being able to view online components from anywhere on any device. For the most part, the online modules and lectures have worked well, but there are instances where students on certain web browsers and mobile devices were not able to view the online modules or lectures. Another major technological issue encountered is related to module and lecture video performance when the file has been uploaded into the learning management system. Once uploaded, the module or video has sometimes found to not be performing as intended. In some cases the issues are found to be related to developmental issues (variables and links within Lectora are set up incorrectly), but many times it has been found that re-publishing will solve the problem.

Other developmental issues that were encountered included videos that were made too long to accommodate student preferences (this was typically not realized until the current students gave feedback). Sometimes the developers of the online content are able to break down or chunk the material enough so that the chunks are sufficiently short, but this depends on the instructor; some instructors do not want to chunk videos as much as students prefer. Another problem encountered with lecture videos was the speaking speed of the narrator can be too slow. Although the developers try and remove all long pauses in lectures, the lecture speaking speed can still seem be slow from a student perspective. A possible solution to this problem would be to have a function that would increase the playback speed of the video, but the software that was

used to develop the course described in this paper does not have such capabilities. Other issues that have been encountered are outline in Table 4.

Another problem that can be encountered that does not fall into the technological or developmental category is the understanding of material by the developer and communication of the instructor. The modules are built to serve the instructors so they can reach their teaching goals. The developer's job is to understand the course teaching goals and build videos and modules to best reach the goals. Thus, if a developer does not fully understand the material, the module or lecture video may not achieve the goals that are intended. Communication with instructors and/or graduate assistants is very important during lecture design and, more importantly, module design to ensure that material is accurate and is appropriate.

Table 4: Example Troubleshooting Matrix

Problems Encountered	Solutions
Students answer the questions correctly, but Lectora records the answers as incorrect.	The developer needs to be careful when creating the modules. Each variables used within Lectora must be named differently. If they are named the same, Lectora, will not record answers correctly
Students are told they didn't answer some questions while they actually answered them.	Recheck every parameter that needs to be matched in the Lectora file. Make sure that each different question has identical parameters that are different from all the other questions.
After answering a question and going to the next page, students could not go back to the last page or previous pages.	Check the settings in the Lectora file for the back button. Look for the conditions for going back.
Once a Camatasia file is moved from one place to another, some pictures will need to be relocated.	Try to work at the same place with Camtasia. If the file has to be moved, try to locate each picture.
Lecturer and students want a speed control in the video. They sometimes feel the video speed is too slow.	Try to apply the Echo center service in the Blackboard Learn System.

Limitations and Directions for Future Research

As the overarching goal was to describe the online material development process, no large scale statistical comparison in terms of the impact of hybrid on student learning was included in this study. A future goal for the research team is to collect student feedback from the current semester course and investigate the effectiveness of the model on learning gain and student satisfaction.

Another possible research effort could be to conduct a comparative case study of the three instructors who can be identified as *innovation champions* of the hybrid teaching in the department. It will be helpful to understand why they were motivated to convert their courses to hybrid format in order to facilitate the dissemination of hybrid course format and institutionalize it.

In sum, the purpose of this paper is to introduce and explain a process that has been successful in developing the online components of hybrid learning course. The educational institutions are gravitating toward this style of teaching and, the process can have surprisingly high requirements in terms of time and finances. Having a good understanding of the required organizational effort, skill requirement, and time commitments can have a determinative influence on the success of attempts to develop such courses. This paper presents a detailed process, along with the required team members, tools, and time investment that were required to develop the online component of a pilot hybrid course. It is the authors' hope that the framework provided will spark more interest in this topic and more research will be conducted to improve such processes in the future.

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