"Best" Practice Suggestions for Custom Building a Technology Class Web Site and Administering the Class

Richard Ryan University of Oklahoma Norman, Oklahoma

This paper discusses a custom-built web site, http://www.ou.edu/architecture/dcns/cns4913/, used to deliver the University of Oklahoma, Construction Science Division cns4913online Construction Equipment and Methods class. The cns4913online class has been taught in conjunction with a lecture class meeting twice a week at the University of Oklahoma. Course content, sequence and assessment have been the same for the web-based and lecture classes. The purpose of this parallel delivery was for direct performance and administration comparison between the two instructional strategies. Using this unique opportunity for comparison and assessment "best" practice suggestions were developed for custom web site design and construction and administration of an online technology class.

Key Words: Construction, Construction Equipment, Distance Learning, On-line Classes, Technology, Web Based Instruction

The Need for "Best" Practices

Successful teaching of technology content (practical or applied science topics) in a distancelearning format is more difficult than teaching most courses offered on-line today. The teaching/learning strategy in current web based classes typically requires individual assignments routing the students to various reading resources in order to complete a paper for submission or to memorize specific answers. Self-paced online assessment can be done quickly and without faculty intervention using simple fill-in-the-blank, true/false or multiple-choice answers. Practical technology courses typically require a more interactive visual based problem solving teaching/learning environment than this. Many times the correct answer has to be determined by formula or understanding a process. Learning the formula or process is the objective of the exercise and the correct answer is a product of this understanding. In many problem-solving exercises, assessment must be based on the approach to the problem and the steps taken in the solution, not just the correct answer. This required assessment and feedback requires much greater effort and communication than simple online assessment. To successfully provide this required teaching/learning environment on-line, technology courses must incorporate more resources, more elaborate learning exercises and more communication between the class instructor and participants. The initial effort required for course development and administration, combined with limited funding, resources, manpower, expertise or a combination of these, is a great motivator for university technology curriculums to create and share on-line courses. These common constraints magnify the need for establishing "best" practices for efficient, economical and effective on-line course development and administration.

Using Courseware or a Custom Built Class Web Site

Collection, creation and organization of content and construction of the class web site incorporating this content are required to develop a class web site. Most online classes offered today are developed by a party other than the instructor or by placing suggested information into courseware to create a class web site. The drawback to this process is that the site builder or course software has no "feel" for the content. To compound this shortcoming, the content expert doesn't understand the platform in which the class web site is being authored, the capabilities of the medium and how these capabilities can be incorporated into a class. Ultimately this will breed mediocre products that will be used mostly for simple information transfer or communication. Without understanding the delivery medium's capabilities, these classes will be "rubber stamped". Having a basic understanding of both content and construction will greatly enrich the style and delivery format that can be incorporated into a web based class. This understanding will lead to better crafting of exercises and use of web-based resources and capabilities.

Available courseware such as CourseInfo or WebCT can be used to create, post and manage classes on the Internet, but they promote setup of class information delivery in a standardized traditional lecture format. Delivery of information is categorized, sequenced and posted to the user as if it was delivered and discussed in sequential class settings. Prepared and grouped PowerPoint notes can be easily converted to html script and posted on the web in the courseware shell. Selection of material for review is linear by order of presentation like a lecture class and delivery is much like looking at overheads or a slide show during a lecture.

This is a rather non-creative approach, but the delivery technique paces the learning rate of the participants. The paced delivery optimizes the participant's building of knowledge on previously learned information. Email, chat and bulletin board features can be automatically included in the class site using the courseware.

A custom-built web site can promote information delivery in a more creative, non-linear and self-paced format. An example of this format is the University of Oklahoma, College of Architecture, Construction Science Division cns4913online Construction Equipment and Methods class. The class web site, http://www.ou.edu/architecture/dcns/cns4913/, is a collection of categorized information and resources organized for exploration at any time by the user. The web site is used in conjunction with other traditional resources, including a text and a manufacturer's specification manual for the class. Exercises are used to promote exploration of all of the information resources to learn principles and applications. This less regimented and sequenced presentation of information in the web site is very suitable for classes with problem solving or evaluation components and promotes a more self-paced format for the class.

Because of the necessary interactive problem-solving environment required for technology courses, effective communication is essential. Participants require effective feedback communication in order to understand how to correct mistakes. Sufficient explanation has to be done online in a distance-learning format without the benefit of face-to-face communication. Successful communication about formulas and processes requires greater effort from the online class instructor and greater responsibility is placed on the participant to communicate reactions,

shortcomings and misunderstandings in a timely manner. More elaborate means of communicating, such as desktop video conferencing or streaming video must be crafted into class administration and learning exercises to promote communication.

"Best" Practice Suggestions

The cns4913online class has been taught in conjunction with a lecture class meeting twice a week at the University of Oklahoma. Course content and sequence have been the same for both classes. Both classes completed the same homework assignments and exams at approximately the same times during the semester. The purpose of this parallel delivery was for direct performance and administration comparison between the two instructional strategies. The January 2000 Technological Horizons in Education Journal (T.H.E. Journal) has more information about the instructional strategies comparison. The article discusses findings using the University of Oklahoma College of Architecture lecture class evaluation criteria as a basis for comparison. "A necessary step toward online class quality assurance is determining how classes are to be evaluated by participants. Regardless of the delivery method, issues of quality are the same. Recognizing that online classes should be evaluated the same as lecture classes is a necessary step to establish standards for quality." (Ryan, T.H.E. Journal, 2000). Using this unique opportunity for comparison and assessment, the following "best" practice suggestions were developed for custom web site design and construction and administration of an online technology class.

The Class Web Site

Setup Web Site File Storage Directories for File Manipulation, Editing and Server Uploading

Proper storage directory structure for web site files is mandatory for authoring, implementing and maintaining a large class site with many resources. Create a "master" directory structure, including the directory in which all of the class site files will be located, subdirectories and sub-subdirectories. Base this structure upon the content categories and subcategories listed in the class syllabus. Create the menu on the web site, the directory structure on the authoring computer and the directory structure on the web server to match this "master" directory structure. This will make manipulating, editing and uploading frequently revised or updated files to the server very efficient for the site administrator. By matching the web site menu selections to the content topics in the syllabus, the syllabus serves as a site map to help users navigate through the content of the web site (see *Figure 1*: Storage Directories).

Use a Consistent Page Format

Create a "master" page. Include appropriate graphics, heading(s), title area and tables for text, images or other types of resources. Build-in typical internal links; such as "return to top of page" and typical external links, such as alternate menu links or links to supplemental sites. Contact, copyright and page author information about can be placed in a table at the bottom of the "master" page. Use this page as a template for subsequent pages that are created. Pages can be edited or customized easily with fonts, colors and page format remaining consistent. Using the

"master" page simplifies and streamlines the web site construction process. The consistent page design and format will help users navigate through information more efficiently.

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Figure 1. Storage Directories

Use a Consistent Page Format

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Use tables to structure the content in a page. Tables that resize to fit the viewing screen automatically and resources included in the page will remain in the same location regardless of the viewing screen. It is easier to organize information for printing or for constant editing in a table (see *Figure 2*: Consistent Page Layout).



Figure 2. Consistent Page Layout

Frames can be used effectively to setup online exercises (see *Figure 3*: Equipment Watch 2). This example is two frames. Both frames have been setup as templates to be edited and used again (the third frame shown on the left of the image is the web site menu). The left frame is the questions and the right frame is an answer submittal form. Frames proportion themselves to the viewing screen and scroll up or down independently of the rest of the screen. Once the answers

are completed online they are submitted directly to the instructor by email. Upon receipt, the instructor opens the email, grades it online and makes comments in a reply email to the sender. The text from the original email is included in the reply email for reference by the user.

Organize the Web Site as an Information Resource

Organize the web site as an information resource with built-in communication capabilities. Searching for information within the content of the web site should be the primary reason that a user visits the web site. The class web site can be a custom information resource used to supplement traditional class resources. Development of the web site is an excellent opportunity for the instructor to use self-collected resources and to express observations and suggestions about specific topics not covered in other class materials. The cns4913 web site addresses topics that the instructor felt were not addressed or were inadequately addressed in the textbook and other course resources. The instructor collected most of the images and video included in the web site to address specific topics about construction equipment and methods not covered in other class materials. The web site is not intended to replace the textbook, but to compliment that information in a visual, interactive and less formal manner.

Use Linked Industry/manufacturer Web Sites to Supplement Available Information

One of the greatest advantages of the web as a medium for delivering a technology class is the ability to greatly enhance and increase the information that can be included in class content. Industry and manufacturer's web sites contain images with explanations, process descriptions, catalogs of products with their specifications, periodicals, service organizations, testing sites and codes and standards. Manufacturers' web sites are created to market and provide services. They typically contain organized quality information created and maintained by responsible parties for industry users. With very little effort, exploration of information contained in these linked web sites can be incorporated into learning exercises (see Image 4: Caterpillar Crane Table). As the internet flourishes as a medium for advertising and providing services, a company sponsoring an academic class containing information about their products or services offers a new kind of opportunity for industry and academia to partner. Sponsoring a web class has great potential for advertising to a very focused audience of emerging potential customers in numerous geographic markets. Generated funds can help support the offering program's recruiting effort and pay for the maintenance and improvement of the web site and class. The potential to create a resource that can be used for simultaneous teaching and promotion by both parties is not explored.

Create and Use the Web Site as an Extension of the Instructor's Personality

An image with appropriate explanation is an effective means of communicating a process or other visual based information. The use of images with text, video and audio is one of the greatest benefits that the World Wide Web offers to construction education. Write image narratives or other discussion in the first person when it is appropriate. Relate personal observations and experiences if appropriate. Students typically enjoy hearing about these practical experiences. This style of information delivery is common in traditional construction lecture classes. The same style can be used in the web site.



Figure 3. Equipment Watch 2

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Image 4. Caterpillar Crane Table

Creative ways of using web site communication features can be incorporated into class administration and communication. Scheduled or random chat discussions with the instructor can be informal and used to minimize the distance learning anonymity. A chat feature can be used to post extra credit work notices or specific answers to questions on upcoming exams. Students will not see the posting unless they visit the web site. Only the ones that go to chat while the message is posted will get the extra credit or know of the potential test question. These examples are small incentives to encourage students to visit the web site and use the chat feature to check for announcements and to post and discuss questions and other topics associated with the class.

Unusual icon graphics or animated files can be used to personalize or make the site more "friendly". Graphics can be used to promote humor, highlight critical points and make navigational associations to a specific class activity or section of the web site. Animated files create a sense of motion or activity that can help understanding and be enjoyable if used appropriately. "Entertainment" graphics require greater download time than text and should be used sparingly.

Class Administration

Standardize Required Technology and Software

Minimum hardware and software requirements for all work in the class should be included in the class syllabus as part of the resources required for class participation. Software compatibility for downloading files from the server, opening and editing files on the user's computer, and transferring the files back to be graded is extremely important. Other hardware needed, such as a desktop video camera, should be also specified in the syllabus. Recommending a camera for purchase by class participants was addressed in the cns4913online syllabus by placing a link to a recommended manufacturer's web site for specific product information and ordering if desired. An agreement with a bookstore to supply the required text can be made and an online order form that is automatically sent to the bookstore can be linked to the name of the textbook in the syllabus. The bookstore receives the online order with a credit card payment and the book is shipped to the class participant.

Use Simple Consistent Administration of Assignments

Post assignments for downloading in a designated area of the class site (see *Figure 5*: Assignments Page). The user can go to this page and download the assignment when desired on any computer that has an Internet connection. It is good practice to notify participants that a homework assignment has been posted and this can be conveniently done using an email listserv for the class. Name the downloadable file posted on the assignments page the same as the subdirectory (folder) in which it is to be stored for grading and return (hw1.doc is the file and hw1 is the folder). The user saves the file when it is downloaded and opens it in the appropriate software for completion when he or she wants to work on it. The file is setup in a traditional question/answer form to be edited by the user and resaved. The edited file should be renamed by the user with the first four letters of the their last name and the original file name (example: ryanhw1.doc: Richard Ryan is the participant; hw1 is the assignment designation and the folder in which the file is stored). If the completed homework is returned as an email attachment use the subject line of email form to designate the subdirectory in which the attachment should be stored (hw1).

Grade and Communicate Assessment Systematically

Exercises that require showing work or calculations for partial credit, fill in the blank or short narrative answers and discussion answers are often necessary in technology classes to evaluate how well students understand what they are learning. This style of assessment places much greater demands for effective and efficient communication on the user and the grader than traditional hard copy testing and assessment. The lack of face-to-face oral communication must be replaced with text comments.

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Figure 5. Assignments Page

Use of Microsoft Office 97 Word (document) and Excel (spreadsheet) software is required as stated in the class syllabus. Both software offer the capability of color highlighting and colored fonts. Incorrect answers or portions of the answers can be highlighted in yellow and as with traditional grading, red can be used to designate point deductions and comments by the grader. Using a consistent coloring and comment format for grading will minimize confusion about notations.

Grading digital assignments is much more time consuming than grading the same hard copy assignments. Communicating assessment based on typed comments is much more demanding than returning and discussing the assessment in a lecture setting. More time and effort must be spent crafting concise, yet adequate assessment comments, due to the lack of face-to-face oral communication that typically takes place when the assignment is returned. Being able to orally address a class all at once and a specific participant face to face to discuss grading and correct answers greatly reduces the need for specific comments to be written on the returned exercise. The lack of face-to-face communication places much more responsibility on the participant to communicate if they do not understand. Participant reluctance or lack of effort to communicate about misunderstandings or misinterpretations is magnified. Face to face communication requires less effort than email or the telephone and emotional feelings can be expressed and viewed by both parties. Emailing or calling on the telephone in an anonymous format requires effective communication without the influence of visual contact.

When assignments are received by email the email letter should be printed for hardcopy verification of receipt and permanently filed. The attached file (assignment) is saved to the appropriate assignment subdirectory for opening and grading later. Then the email is filed to the appropriate email subdirectory for storage and verification of receipt if necessary. Individually each of the saved attachments is opened, reviewed, graded, the grade is recorded and the file is resaved under the same file name. If a hardcopy of the assignment is printed, then the cover email sent with the assignment can be stapled to it for permanent storage. Students can use the cover email to discuss problems that they had with the assignment to alert the grader about possible areas of focus and better explanation. Individually the stored email from each participant is reopened and reply is selected from the email software menu. The return email is automatically configured and the graded file is attached and sent back to the participant.

Minimize the Use of Off-site Faculty

Online classes should be formatted and administered to minimize the need for off-site faculty intervention. Using off-site faculty intervention is contradictory to what is appealing and beneficial about online classes. Determining the need for off-site intervention will be greatly influenced by the appropriateness of the class content for delivery in the web medium. An important role that off-site faculty can play is the promotion of online classes to prospective participants at their universities. An email announcement was sent to all member programs of the Associated Schools of Construction announcing the cns4913online class. To aid in the class marketing a limited preview site, http://www.ou.edu/architecture/dcns/cns4913ol/preview/, was placed online so prospective students could get a feel for the class web site and administration of

the class. The current need for specific class marketing will change as online courses become cataloged in university curriculums and promoted at the national level. *Match the Testing Format to the Appropriateness of the Class Content*

One of the determinants of the appropriateness of class content for delivery using the web is the degree and method of testing that is suitable to access participants' understanding. The anonymity of the distance-learning format places a large responsibility on the participant to follow specified guidelines and to do work independently when required. The instructor has to rely on the participant to do this, unless some other verification mechanism is used. Off-site faculty can be used to proctor exams and verify compliance of rules if this is determined to be necessary. This places an extra coordination burden on the class instructor. As part of the syllabus for the class it might be required that the participant enlist a responsible party at their location to insure and verify compliance. Eventually universities may have centers dedicated to proctoring assessment exams for online classes and verifying compliance of participants to course requirements. Developing effective and reliable assessment methods for online class participants perhaps will demand the greatest effort for innovation and departure from traditional practices.

Relate Practical Exercises to the Diverse Geographic Locations of the Participants

Practical exercises can be crafted to explore and compare conditions of participants' possible diverse geographic locations. This is especially suitable for technology courses. Diverse work environments and local market customs and standards can be incorporated into problem solving exercises. Exercises can be fashioned for self-exploration of a specified topic or set of questions and collaboration required for comparison and analysis. Class participants' best reports, findings or observations can be posted on the class web site for all class participants to review, conveniently adding to the available information about the topic.

Class Interaction and Communication

Work to Overcome Limited Personal Instructor Interaction

The limited personal interaction between the instructor and class participants is a perceived major weakness of online classes. In a typical online class the instructor has never had the participants in a previous class and background information regarding their typical effort and performance is not available. Participants have never had the instructor for a class, so they are unfamiliar with the instructor's mannerisms and communication preferences. This creates a natural awkwardness in the online communication process between the instructor and the class participants, especially about assessment issues. This awkwardness has to be minimized for effective communication to take place. The instructor can take the lead to minimize this awkwardness by being less formal in emails, announcements and chat room postings to participants. Sharing interests about class content and how presented information can be used practically are good topics for informal discussion. National or regional items or events relating to class content provide common ground for discussion also. Using the class listserv an email discussing the past weeks events, the current class status and upcoming class activities can be

conveniently sent at the end of each week to each participant. This email can also be used to openly encourage communication between participants.

Work to Promote Participant Communication and Collaboration

Another of the primary determinants of the appropriateness of class content for delivery using the web is the amount of independent learning or collaborative learning that needs to occur in the class. In a traditional lecture class many participants are reluctant to contact other class participants for help or social interaction. Email, chat and video conferencing are the primary ways that this interaction can occur online. These communication methods have an anonymous quality that makes interaction more difficult. Participants' typical reluctance to communicate can be magnified or minimized by the impersonal nature of Internet communication. Those needing to have face-to-face interaction may communicate less, while those preferring anonymity may communicate more.

The opportunities to work independently at one's own pace and to communicate anonymously are two of the primary advantages of an online class. Special effort must be made to promote necessary communication and interaction in classes utilizing problem solving and team exercises. To do this effectively online demands much greater effort than a traditional class setting.

A communication page should be created with all participants' linked email addresses and a link to the class chat feature. Links to participating universities' web sites and participant's home pages, pictures or short bios containing background information and interests are a simple means of removing some of the anonymity about the participants.

Use the Telephone, Desk-top Video Conferencing and Chat

Online class participants need encouragement to communicate regardless of the medium. Though not the most economical, the telephone is still the most efficient and easiest means of communicating person to person. A desktop video camera is affordable technology that extends the concept of the telephone to include visual communication. The concept and technology is effective, but the Internet's current ability to transfer data is not sufficient. Point to point visual and oral communication using web based video conferencing is not real effective because of poor quality audio and video transmission. Trying to have an online session for explaining assessment of an exercise or an online office hour during high internet traffic times will greatly decrease the quality of the transmission. Today web based video conferencing is not as effective as communication in an online class using desktop video cameras is essential. Current web based video conferencing is a primitive form of the future telephone and television and will be an essential element for communication in future online classes. The medium's affordability and ease of setup make it appropriate for effective and economic communication.

A text chat feature can be used for real time communication or threaded discussion like a bulletin board. The major drawback to Internet real time text communication is the speed of the process. This process is often dictated by how fast the user can assimilate and type thoughts to the other party. Communicating in this manner requires much greater effort than oral communication, because of the required typing. As users become familiar with the chat process, their typed comments become more efficiently worded.

Require On-line Common Time for Interaction

Regardless of the delivery strategy for the class, participants want the instructor to be accessible for questions, feedback and general expressions of feelings. Meeting in a classroom at the required time is the primary catalyst for this communication typically. This traditional expectation of the classroom experience is more difficult to meet in a distance-learning format. Even if lectures are videotaped and posted for review on the web site, participants still require interactive time for clarification and discussion. Online office hours in the chat room or video conferencing at a designated time several times each week can help provide this catalyst for communication.

Quality Instruction Verses Class Convenience

The quality of content and administration of an online class should be at least as good as for the traditional lecture class. This quality should not be compromised for the sake of posting the class online or for the convenience that using the Internet brings. The opportunity for enhancing the teaching process using web-based resources and capabilities is just beginning to be explored and the opportunities are great. This discussion hopefully highlights several "best" practices that will promote the quality of online technology courses.

References

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