

## The Classroom: Online

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### Abstract

The online classroom features a near-paperless environment built around a web site and presentation software. This evolving educational paradigm provides numerous opportunities that must consider all learning types (visual, auditory, kinesthetic). We begin with a discussion of web site design including organization, use of themes, Windows-to-Unix conversion, and access control. Next, we review many of the common tasks involved in creating and delivering effective electronic presentations such as the role of the laptop, figure downloads and scans, equations, and use of color and animation. A student survey was conducted to acquire data on the relative acceptance of a specific implementation. Results indicate that students liked the web because it was organized, easy to use, and helpful. Conversely, they were less positive about the presentation software and preferred transparencies, a white board, and paper handouts. The reasons are not obvious but perhaps it's a resistance to change or a clash with their learning style.

### Introduction

This paper addresses how the world-wide-web and use of presentation software supports an online, always available, classroom environment. We have only begun to understand the significance of the Internet as it applies to engineering education and many predict profound changes in how, when, where, and what we teach.

We assume that the reader is an Engineering Educator familiar with the use, or authoring of, web sites, email, file servers, and presentation software. In addition, we focus on the lecture-style teaching format, as it is the most common technique in practice today. Specifically, we do not discuss distance learning paradigms nor implementation specifics such as costs, ROI analysis, and integration with campus IT Services. Expectations for this paper include an understanding of the options available to support classroom web sites and suggestions for effective use of presentation applications.

The next section sets the context of the paper and discusses how the personal computer and Internet provide new educational opportunities. Following this, we look at the web services offered by commercial vendors and contrast it to the custom-designed web site. Next, we describe experiences

with presentation software that includes use of objects (figures, equations, charts, tables) and animation to assist student learning. To demonstrate how students react to the online classroom, we describe a survey that focuses on web site and presentation applications. The sample set includes two classes: a Junior-level required course, and a Senior-level elective course. Finally, we finish the paper with conclusions and recommendations for further study.

## Background

Few will argue that the personal computer (PC) and world-wide-web (Internet) have ushered in a new technology revolution with significant impact to everything from our global economy to how we lead our everyday lives. As a result, the Engineering Educator now faces a host of new opportunities including:

- Increasing enrollments,
- Shifting demographics,
- Overburdened faculty and staff,
- Rising student expectations, and
- Increased competition.

But for each of these concerns, technology and its application promises to offer exciting solutions. It will require educators to innovate and adapt to changing times. The use of web sites and presentation applications represent two recent changes that support the online classroom, or near-paperless instruction. We use the term *near paperless* because most engineering instructors use problem-based assessment and that is difficult to implement online. Thus, tests require paper for students to demonstrate their work and to receive partial credit. In summary, institutions that capitalize on this paradigm shift will take advantage of the above opportunities and improve the quality of their educational programs.

## Websites

The educator may choose to use web site services offered by e-Learning vendors or may choose to author the site and host it locally on campus. First, we look at what is commercially available, and then we discuss some of the issues in designing and publishing your own web site.

**e-Learning Vendors.** A quick check of *Yahoo!'s* ([www.yahoo.com](http://www.yahoo.com)) distance learning section illustrates the large number (>75) of commercially-available web-based learning products. Table 1 provides a representative sample.

The extent of capabilities and corresponding costs range widely. Focus on distance learning or on classroom support separates the products into major groups. Also, some emphasize the commercial environment and some the educational (K-12, college, etc.). Commercial use includes new-hire orientation, employee training, and sales support. These are usually not optimal for higher education. Once you review the features, it is quite easy to find the products with educational focus.

**Table 1. Sample of e-Learning vendors.**

Vendor	URL
Blackboard, Inc.	<a href="http://www.blackboard.com/">http://www.blackboard.com/</a>
WebCT, Inc.	<a href="http://www.webct.com/">http://www.webct.com/</a>
Macromedia, Inc.	<a href="http://www.macromedia.com/software/elearningstudio/">http://www.macromedia.com/software/elearningstudio/</a>
Unext.com, LLC	<a href="http://www.unext.com/home.jsp">http://www.unext.com/home.jsp</a>
Prometheus	<a href="http://www.prometheus.com/">http://www.prometheus.com/</a>
Quelsys Inc.	<a href="http://www.quelsys.com/">http://www.quelsys.com/</a>
Geteducated.com, LLC	<a href="http://www.geteducated.com/">http://www.geteducated.com/</a>
ECollege Inc.	<a href="http://www.ecollege.com/">http://www.ecollege.com/</a>
gForce Systems, Inc.	<a href="http://www.gforce.com/home.html">http://www.gforce.com/home.html</a>

Some of the capabilities provided by the commercial vendors include administrative tools, assessment utilities, collaboration services, and database facilities. Ideally, these capabilities would integrate seamlessly with existing and future campus IT offerings. The administrative tools may provide sophisticated features such as authentication (security), course registration, grade book, announcements, calendar, and student tracking. Assessment utilities include true-false and multiple choice question pools, random exam creation, and individually-timed exams. As discussed earlier, it is difficult to automate problem-based exams. For collaboration, the products offer both synchronous (request, immediate response) and asynchronous (request, delayed response) services. These include email, chat rooms, bulletin boards, and document sharing. Some educators hold office hours using the synchronous chat room feature. Lastly, the database facilities include a file system for access to syllabus, lecture notes, laboratory experiments, etc. A user may search the database to retrieve information. Such a database provides a centralized, up-to-date repository for course materials. Many of these features are not new, but providing them in an integrated application represents a recent development.

How you host a web site influences the cost. You may contract with an Internet Service Provider (ISP); the vendor will gladly to recommend one. Or, you may host the site locally on your campus or department server. The vendor-ISP option often requires a contract but includes maintenance. Local hosting may reduce cost, but compatibility issues are common.

**Custom Web Sites.** The educator can develop many of the capabilities of the commercial products from *scratch*. But it takes some know-how. Web servers interpret a language known as *hypertext markup language* or HTML. Early adopters<sup>1, 2</sup> created their sites using the specific HTML commands in a text file. It is no longer necessary to develop a web site in this native, low-level command language as numerous software vendors provide web-authoring tools analogous to a compiler. This change somewhat mirrors the transition of word processors as they moved from command line interpreters to *what you see is what you get* (WYSIWYG) interfaces. For practical purposes, today's web authoring tools are WYSIWYG. But they do generate a large number of files just as compilers often generate larger programs.

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# EE 333

## Spring 2002

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Instructor

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Course Desc

Syllabus

Exams

Laboratory

Homework

Projects

Discussion

Links

### Welcome

This is the EE 333 class web site. Its purpose is to provide a centralized and up-to-date location for all course-related information. As a web site, it is easily accessed and maintained for accuracy.

Students are encouraged to submit comments using the *feedback* page.

### News Flash

The following table contains *News Items* of important information as they occur. They will be posted sporadically.

Date	News	Detail
01/14/02	Classes start	<a href="#">News 1</a>

OREGON'S CATHOLIC UNIVERSITY

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For more information, questions or comments send email to: [lillevik@egr.up.edu](mailto:lillevik@egr.up.edu)

**Figure 1. Online classroom *Home* page.**

Step one in web site development is to define your page structure. Some webs suffer because they entail too many levels. We suggest you limit the site to two levels: parent, and child. Beyond that it becomes difficult to remember where you are and how to navigate among pages. One approach is illustrated in Figure 1. Here, the parent level includes the Home, Contents, Search, and Feedback pages. At the lower child level, the pages include Instructor, General Information, Course Description, Syllabus, Exams, Laboratory, Homework, Projects, Discussion, and Links. Table 2 identifies each page and summarizes the information it provides. With a web authoring application such as Microsoft's FrontPage<sup>®</sup>, the pages are created and arranged using simple drag-and-drop actions.

**Table 2. Class web pages and contents.**

Page	Contents
Home	Entry point for web, posts important news
Contents	Overall web map
Search	Finds key words in web
Feedback	Send email message to instructor
Instructor	Office, phone, office hours
General Information	Expectations, classroom, hours, text, grading, attendance policy
Course Description	Catalog description, prerequisites, credits
Syllabus	Text assignments, links to lecture notes
Exams	Study guides, exam solutions
Laboratory	Laboratory exercises
Homework	Homework assignments and solutions
Projects	Project description
Discussion	Discussion page
Links	Links to references, library, collateral

The next step is to edit the individual pages (separate files) by deciding upon shared borders: top, left, right, bottom. These are similar to document headers and footers in that the information appears on each page and need only be entered once. In Figure 1, all borders are used with the exception of the right side. The top border contains a parent-level navigation bar that allows the user to move to another parent page. Also, the top border holds some header-like information (course number, semester, current page).

Next, the left border contains another navigation bar but this time it points to the child-level pages. With FrontPage, the user does not need to know how to write the HTML for the navigation bars. A simple

insert places the navigation bar into the borders. Finally, the bottom border contains the school affiliation, contact information, and legal notice. Once you complete the borders, you may enter information into the body of your page. This step is identical to entering information into a word processor.

Style sheets or templates make word processor formatting easy because changes to the document only require changes to the style sheet and not a total document re-write. FrontPage offers a similar feature known as *themes* to provide consistency and ease-of-use. A theme defines the overall page properties such as headings, fonts, colors, navigation bars, etc. It allows all the pages to look the same within a web or across a department or institution. Again, changes to the web only require changes to the theme. Further, an author does not need to design the theme but only use it. To create a theme, we suggest you start with one supplied by the web authoring vendor and modify it (school colors, logo, legal statements, etc.) to meet your requirements. This may involve editing some of those many files that the tool creates.

Some of the capabilities offered by the commercial e-Learning vendors require more advanced authoring skills and more advanced server capabilities. These powerful interactive features include forms, discussion groups, and databases. Forms allow the web site to collect information from a user such as their student number for authentication. You create a form by defining fields, rules for data entry, and a form handler to decide what to do with the information. The discussion group provides faculty and students a forum to synchronously or asynchronously exchange information on a subject (say a homework problem). Users can create a subject, post comments, read comments, and reply to a subject. Lastly, the database capability holds information that a user may search, retrieve, or add/append. To create a database, you must define records, entry forms, filters, and reports. The database corresponds to a very powerful feature but one of complexity. For each of these interactive capabilities, you should always include a confirmation page for the user to verify data entry. Remember that not all web servers will support these interactive capabilities.

Once you create the web site, you must evaluate it before you publish it (write the files to the server). First, see that the tool does not generate any errors (i.e., missing links). Then, publish the web to an offline server or a test file on your PC hard drive. The offline test often uncovers some errors not caught by the authoring tool. Finally, publish your web to the actual web server and check it a second time logged in as a user. We suggest that you never make revisions to your web around a critical time in the semester such as just before an exam. If it can go wrong it will. Most authoring tools provide several publishing options so that you may transfer all of the web files or only those that have changed (update). A full publish often requires much time.

If you use a file transfer program such as FTP to publish your web and move all the files, FTP will prompt you for the server location, user name, and password. File compatibility creates some run-time errors and is common moving from the Microsoft environment to UNIX. Avoid file names with capital letters or spaces or some special characters as UNIX interprets file names differently than Windows.

Also, remember to specify only the server options on your web authoring application that the server actually supports (e.g., ActiveX, Java, dynamic HTML). We cannot over emphasize the evaluation of your web. Never skip this important step!

All web sites require some form of security beyond logging onto the campus system. Generally, you may grant permissions (read or write) for large, narrow, or single groups of users. In UNIX, this corresponds to the *other*, *group*, and *user* subsets, respectively. We use the UNIX *chmod* utility to control website access. Recently, textbook publishers request that you protect access to homework solutions because students not in a class will search the Internet for homework solutions. To do this, we use a password to open the homework file. For Microsoft and other servers, protection requires use of an access control list or ACL. We recommend that you consult with your local IT support for the best approach.

## **Presentation Applications**

A presentation application is a tool that creates visual lecture material (i.e., slides). It duplicates the time-honored chalkboard but in an electronic media. Educators use the application to introduce material, complement the text, and clarify concepts. Microsoft's PowerPoint<sup>®</sup> represents a common presentation application. In this section, we start by looking at learning styles, then move to templates, objects, animation, and delivery.

When you design a lecture, it's important to keep in mind your audience and they may be described by their learning style: visual, auditory, or kinesthetic<sup>3</sup>. The visual learner (65%) must see the information, the auditory learner (30%) must hear the information, and the kinesthetic learner (5%) must experience the information. Actually, most students prefer some mix of the three learning styles. So, your lecture must appeal to all types of learners and this represents a tall task.

Just as the style sheet and theme offer consistency and ease-of-use for documents and web sites, respectively, slide *templates* serve the same purpose for presentation applications. We suggest that you use the header and footer fields to include course number, semester/date, instructor, logo, page number, file name, and legal notice. The template includes a slide *master* that creates the overall format of the presentation. Format the master with your school colors and font schemes. For clarity, do not put too much on one slide. Limit the master to two levels of indentation and around 5-6 lines of text. Any more, and students in the back of the room cannot read the slide. Avoid dark slide backgrounds because they require very good (\$\$) projection equipment.

In addition to text, your lecture slides will include objects such as clip art, figures, equations, charts, tables, and items imported from another application (document, spread sheet, etc.). Remember to check copyright and trademark restriction when inserting any object. Clip art (drawings, shapes, etc.) is provided by the application vendor and easy to insert. We have not found it to be all that helpful.

Figures, particularly those from the text, provide the bulk of the objects inserted into your slides. At all cost, avoid re-drawing them because it takes too much time. Instead, see if your publisher provides a web site for you to download them. If not, you can scan them from the text but this often results in loss of resolution and large file sizes. For equations, use an equation editor. Initially, they take some time but do produce high-quality equations and easily create differential equations, integral, and matrices. Generally, charts and tables are not difficult to either generate or import. Again, they require a learning curve. Finally, you may wish to import (cut-and-paste) objects from another application. Not hard to do, importing from an application may result in a large file size. Also, sometimes you import more than what you intended. For example, if you import a chart from a spreadsheet, you may get the entire spreadsheet (although hidden). All of these objects come in a number of formats that vary in size, resolution, and compatibility. The educator using a presentation application must master working with multiple types of objects and object editors.

To design your lecture for all three types of learners (visual, auditory, kinesthetic) requires adding animation to your slides. Animation controls the initial, intermediate, and final view of each slide. With no animation, all text and other objects appear at once. With animation, you control the sequence that the objects appear. This allows the educator to illustrate a sequence and/or show emphasis. For example, a mathematical derivation may involve four steps. With animation, you break the derivation into four equation objects and then tell the application the order you wish to display them on the slide. So, when you present the slide, the student first sees the initial equation, the second, the third, and fourth. Animation brings action to an otherwise still slide. It's the same action that lecturers have used for years with the chalkboard. But now they may include in their lectures a wide range of objects (e.g., text figures) not possible in the past. In addition, animation assists the learning style of individual students.

When you complete development of your lecture slide set, you can add it to your web site. Then, the students can download the file, print it out, and use it to take notes on during lecture. Delivery of your lecture requires both a PC and some projection device. Because of flexibility, we have found that a laptop works best but a workstation and network drop is acceptable. Projection devices vary widely and may be fixed to a classroom or mobile. Be sure to test your laptop-projector combination in advance so you know how to adjust the settings. Popular accessories for electronic presentations include a laser pointer, data cables, extension chord, and multiple-outlet box. Remember to be prepared. There is nothing more frustrating than a lecture that fails due to equipment problems or, worse yet, operator error.

## **Student Survey**

A student survey was conducted to acquire data on the relative acceptance of a specific online classroom consisting of a custom web site implementation and presentation application. We start with the methodology, then review the results, and finish with an interpretation of the data.



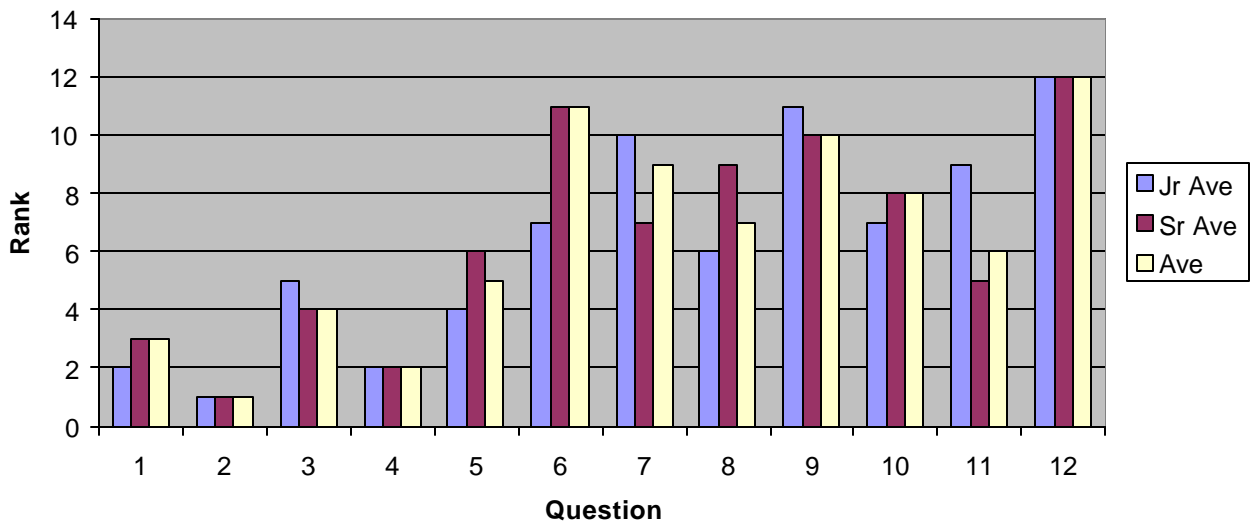
**Methods.** Two undergraduate classes were sampled consisting of 20 students each. One class was a Junior-level course required of both CS and EE students. The second class was a Senior-level course offered as a technical elective for both CS and EE students. A 12-question survey was prepared with the first 6 questions focused on the web site, and the last 6 questions focused on the presentation application. The format followed the standard teacher evaluation style prepared by the university. Responses ranged from 0 to 4 with 0 corresponding to *very little*, 2 to *acceptably*, and 4 to *very much so*. All questions were phrased so that a larger number represents a more positive response to the question. Table 3 contains the questions for the survey. The survey was optional and responses kept anonymous.

**Table 3. Online classroom survey questions.**

Number	Question	Average Response	Standard Deviation
1	Did you find the class web site helpful?	3.1	1.0
2	Did you find the class web site organized?	3.4	0.9
3	Did you find the class web site keeps you up to date?	3.0	1.2
4	Did you find the class web easy to navigate?	3.2	1.1
5	Did you find the class web site always available (time outs)?	2.8	1.2
6	Do you prefer a class web site to paper handouts?	2.0	1.3
7	Did you find the powerpoint slides helpful?	2.5	1.0
8	Did you like the powerpoint color scheme?	2.5	0.7
9	Did the powerpoint animation help clarify the material?	2.2	1.0
10	Did you find the powerpoint figures clear enough?	2.5	0.7
11	Did you find the powerpoint equations readable?	2.6	1.0
12	Do you prefer powerpoint lectures to transparencies or whiteboards?	1.7	1.3

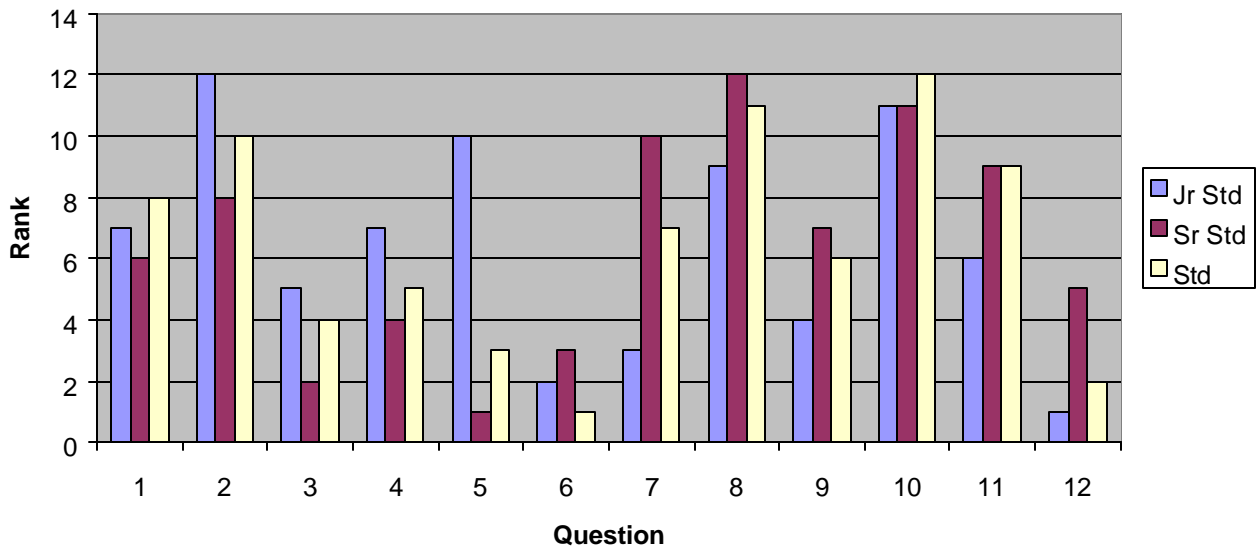
**Results.** Only 11 surveys were returned from the Junior class but 17 were submitted from the Senior class. Since the samples sizes are so small, we must assume a large margin of error. Raw data were entered into a spreadsheet and for each question the average and standard deviation calculated for the combined classes and for the Junior and Senior classes, respectively. Rather than present actual numbers, the data are ranked from 1 to 12 with the top rank (1) corresponding to the highest average (most positive) and lowest standard deviation (most agreement).

Figure 2 shows the average (ranked) survey results for each question. Questions 2-4-1, respectively, received the highest ranking while Questions 12-6-9 the lowest ranking. Generally, the two classes agreed with the exception of Questions 6-11-8.



**Figure 2. Online classroom survey response averages.**

Figure 3 illustrates the standard deviation (ranked) survey results for each question. Questions 10-8-2 received the highest ranking so the responses varied the least. Conversely, Questions 6-12-5 provided the lowest ranking and here the students did not agree. Questions 5-7 offered the greatest difference between the Juniors and Seniors.



**Figure 3. Online classroom survey response standard deviations.**

**Interpretation.** So what does this all mean? If you average the ranks for the web questions (1-6) and the presentation questions (7-12), we see that the students were more positive about the web services than the presentation application.

They liked the web because it was organized, easy to use, and helpful. They did not like the presentation application because they preferred transparencies, white board and paper handouts, and they did not value animation. The Junior class was more positive on paper handouts and use of color, while the Senior class liked the equations. It is possible these results indicate a resistance to change. They like the web because it saves them time, but they are not used to the presentation application because it is different than the chalkboard lectures they've become accustomed to. Also, it is possible that the presentation application clashes with their individual learning styles. Further study is necessary to validate this interpretation.

From the chart of standard deviations, we see that there was more agreement on the presentation application than on the web site. There was agreement on the use of color and figures in the lecture slides and little agreement on the web availability (up-time) and preference to paper handouts. The Juniors appear to experience differing issues with availability while the Seniors differing issues with the helpfulness of the slides. It is possible that agreement on the presentation application is better because of the change in lecturing paradigm (equally negative). Again, further study is needed. Also, we find it difficult to interpret standard deviation data given the small sample size.

## **Conclusions**

We discussed the online, near paperless, classroom based on a web site and presentation applications. For web sites, we looked at the characteristics of vendor-supplied packages and compared capabilities to a custom approach. Learning styles play a major role in how you prepare a lecture while presentation applications facilitate its preparation and delivery. Lastly, we reviewed a student survey that measured the acceptance of a specific online classroom implementation.

To plan your online classroom, begin with an assessment of your needs both today and in the future. This may include a by-course, by-program, by-department, by-college, and by-university perspective. If you plan to take the vendor route, prepare an RFP and determine your selection criteria. Don't forget to plan your deployment, conduct a beta program, and develop a method to measure success.

If you plan to design your own web sites, we suggest you adopt a single authoring tool and one that supports themes for consistency and ease-of-use. Further, review your web server capabilities so that they fully implement the desired features of your authoring application. The web feature area ripest for innovation is the interactive capabilities. This is where we expect many of the new advances to occur.

Some instructors say that using a presentation application takes too much time. Once you go beyond the learning curve there is no difference. But when you make changes, the software method will be faster (lots of cut-and-paste). For the visual learner, remember to include graphics and animation. For the auditory learner, insert sounds clips and other audio files<sup>4</sup>. Finally, for the kinesthetic learner, try posting only a lecture outline, require students to print it out prior to class, and then fill it in during lecture. Fleshing-out the outline provides the action so needed by the kinesthetic learner.

As with web sites, we predict that the ripest area for innovation is in use of new media types. Some which may not exist today. So, we encourage you to continue to exploit new technological developments as they occur. Focus on more interactive, hands-on learning, and possibly an entirely new educational paradigm that adapts, in real time, as students acquire knowledge.

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