Lessons from Teaching Engineering Economy as a Hybrid On-Line Course Using WebCT

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This paper summarizes the results of research and lessons learned in teaching Engineering Economy on-line as part of the "Collaborative On-line Learning and Teaching" (COLT) Program at Cal Poly Pomona. Based on research proposals, twelve faculty members were chosen from across the campus to teach existing traditional courses as on-line courses and compare on-line results to results from traditional teaching formats. The author's proposal to teach Engineering Economy (EGR 403 Capital Allocation Theory) was accepted. To prepare for teaching on-line, all participants engaged in a summer-long on-line course in collaborative, on-line teaching, a one-week course in Dreamweaver (web page development and management software), and a one-week course in WebCT. Release time was provided to prepare on-line materials. This paper discusses the teaching strategies and learning activities used, testing strategies, communication methods, learning results, and the strengths and weaknesses of WebCT as an on-line web hosting system.

The paper is organized into the following five parts:

1. Introduction
2. On-line teaching options, strategies, and considerations
3. Teaching strategies and learning activities for Engineering Economy
4. Strengths and weaknesses of the WebCT course management system
5. Findings, Conclusions, and Recommendations

Part 1 - Introduction

The author has been using web-related technologies to assist with teaching since 1997. From 1997 through Spring 2002 the primary on-line technologies used were internet search engines, course web pages, and email. In Fall 2002 and Winter 2003, WebCT was also incorporated at varying levels of usage for teaching engineering economy. For the 2002-2003 academic year the author was involved with a campus research program call the "Collaborative On-line Learning and Teaching" (COLT) Program. Twelve faculty members who submitted acceptable proposals were part of a campus research project to work collaboratively and explore how on-line teaching and learning could be used and whether there could be measurable benefit to the campus community. Results were documented and presented to the campus community.

Part 2 - On-line Teaching Options, Strategies, and Considerations

There are many new books and articles that talk about on-line teaching and learning in higher education. One very excellent article talks about the usage of web technology as a

ten-level continuum 1. This model has proven very helpful as basis for structuring the conversation about the use of web technology and is worth repeating. Each level represents increasing use of distance related technology. (Note: A recent email response from one of the developers of the ten-level continuum indicated that there is now a 12 level continuum, "The 10 level framework mentioned in that chapter is now 12 levels (Level 11 is Fully Online Universities or Cyberuniversities as they say in Korea and Level 12 are consortia of universities offering online programs and degrees)").

Table 1 - Ten Level Web Integration Continuum

Levels 1 - 5: Informational use of the web		
Level	Web usage	Remarks and/or examples
1	Marketing/Syllabi via the Web	Instructors use the Web to promote Course and teaching ideas via electronic flier and syllabi.
2	Student Exploration of Web Resources	Students use the Web to explore pre-existing resources, both inside and outside of class.
3	Student Generated Resources Published on the Web	Students use the Web to generate resources and exemplary products of the class. (e.g., students can post reviews or papers. PowerPoint presentations can be uploaded to the Web.)
4	Course Resources on the Web	PowerPoint presentations, study guides, lecture notes, homework solutions, prior work, and other materials can be made available via the Web.
5	Re-purpose Web Resources	The best student and other work from previous classes is adjusted and used as a resource for future classes. A very powerful concept.
Levels 6 -10: Required Web Activity		
6	Substantive and Graded Web Activities	Students participate with classmates in Web-based activities such as weekly article reactions or debates as a graded part of their course requirements
7	Course Activities Extended Beyond Class	Students are required to work or communicate with peers, practitioners, teachers, and/or experts outside of their course, typically via computer conferencing.
8	Web as an Alternative Delivery System	Local students with scheduling or other conflicts use the Web as a primary means of course participation, with the possibility of a few live course meetings. (Courses that include live or face-to-face sessions are called *hybrid* courses).
9	Entire Course on the Web for Students Located Anywhere	Students from any location around the world may participate in a course offered entirely on the Web.
10	Course Fits Within Larger Programmatic Web Initiative	Instructors and administrators embed Web-based course development within larger programmatic initiatives of their institution.

Levels 1-5 of the continuum refer to usage that supplements or streamlines traditional teaching and learning activities. These levels are transactional in that they do not substantially change the

pedagogy of the course or teaching style of the instructor. They are attempts to implement technological improvements to the way material is distributed and how communications and research are conducted.

In levels 6-10 of the continuum, the learning strategies and activities are significant changes to the traditional pedagogy of higher education. At many universities they require transformational change by the faculty, students, and institution. Everyone needs to adjust to major changes in the in way they view the educational process and the assessment process.

The author has done substantial work at levels 1, 2, 3, 5 and 8. Students have been asked for several years, for example, to explore financial and other web sites and submit a review to share with other students. These types of assignments would be levels 2 and 3.

Level 6-7 activity most likely includes the use of threaded discussions to bring students into active participation with course materials. The literature strongly suggests that threaded discussions be used to engage students. Participation is required. Students are asked to post discussion questions of their own and respond to discussion questions from the instructor and others in the class or on their team. As a learning community develops, students become engaged in the course material.

Levels 8-10 require that some or all of the course material be delivered electronically. This can be done over the web or with CD-ROM. The advantage of CD-ROM is that connectivity and equipment availability is simplified to the need for a computer that can run the CD-ROM, and handle low bandwidth access to the internet and email.

Part 3 - Teaching Strategies and Learning Activities for EGR 403

Introduction: The EGR 403 Capital Allocation Theory course was divided into four curriculum components for purposes of designing teaching strategies and learning activities:

1. Basic concepts (e.g., compound interest, cash flow diagrams, etc.)
2. Terminology (e.g., interest, compounding period, inflation, nominal interest, APR, etc.)
3. Analysis Methods (e.g., Present Worth Analysis, Annual Worth Analysis, etc.)
4. Applications (e.g, case study, project, problem solving, company visit, etc.)

After discussion of alternatives with a collaborative team, department colleagues, and experts from instructional technology, the following methodology was chosen for delivery of course content for EGR 403 in the hybrid course format:

1. Lecture materials were developed into PowerPoint presentations. This took some time as tables, graphs, and other illustrations had to be made as necessary. Adobe Photoshop, scanned images, EXCEL, and MS Paint were used to create the graphical images.
2. Narratives of the PowerPoint presentations were recorded in a sound studio on campus to make streaming audio files. Hyperlinks were put on the first slide of each presentation of the narratives. Clicking on the links connected the presentation to the streaming audio on the campus server providing sound for the presentation.

3. What was normally a two-hour lecture ended up as one or two 15 - 25 minute narrated PowerPoint presentations.
4. Students could go through the presentation the first time with the streaming audio narrative, and then only as desired during subsequent viewing. These options serve both auditory and visual learners well.
5. Students were asked to complete an on-line "Learning Styles" questionnaire and analyze their own learning style relative to the options they would have for learning the material. They were asked to submit their analysis as the first homework assignment.

Table 2 shows a listing of the PowerPoint presentations used for the on-line delivery of course material. Chapters refer to the Newnan text: Essentials of Engineering Economic Analysis, 2nd Edition (2001), Engineering Press. Austin, TX

Table 2 - Narrated PowerPoint Presentations Used for EGR 403

No.	Title	Time (minutes)
1	Introduction to Accounting Part 1	23
2	Introduction to Accounting Part 2	22
3	Break even analysis Part 1	10
4	Break even analysis Part 2	13
5	Chapter 3 - Interest & Equivalence	48
6	Chapter 4 - More Interest Formulas	17
7	Chapter 5 - Present Worth Analysis	26
8	Chapter 6 - Annual Cash Flow Analysis	12
9	Chapter 7 - Rate of Return Analysis	24
10	Chapter 7a - Difficulties Solving for an Interest Rate	7
11	Chapter 8 - Incremental Analysis	19
12	Chapter 9 - Other Analysis Techniques	22
13	Chapter 10 - Depreciation	23
14	Chapter 11 - Income Taxes	22
15	Chapter 12 - Replacement	21
16	Selection of the MARR	9
17	Retirement Planning - Part 1 - Introduction	5
18	Retirement Planning - Part 2 - Retirement Capital Needed	12
19	Retirement Planning - Part 3 - Saving Strategy	13
20	Retirement Planning - Part 4 - Investing Strategy	14

Future plans are to put the PowerPoint presentations and audio files on CD-ROM. The CD-ROM would be sold in the campus bookstore along with the textbook.

After much exploration and discussion with COLT Team colleagues during a summer on-line course, two on-line learning strategies and subsequent learning activities were planned for the course.

Learning Strategy #1: Personalize and engage the student in the subject matter and communicate with them often 2.

Learning Activity #1: The first three components will be taught mostly in a linear, process oriented style. However, to generate engagement students will be asked along the way to create their own retirement plan scenario to illustrate the concepts, terminology and methods in a way that should interest them. The normal lecture material was supplemented with a four-part PowerPoint presentation on retirement planning that included information about retirement plans and investing options. A basic EXCEL template was provided as a starting point for each student to develop their own retirement plan and sensitivity analysis. In the end they had some idea about how much they will need to save over their working career in order to retire with the lifestyle they desire 3.

Results of Learning Activity #1: Students learned how to apply course concepts and use an EXCEL spreadsheet to make financial calculations. They also learned how to perform sensitivity analysis using the spreadsheet. They learned how to summarize their results in the form of an executive summary. No negative comments were received during assessment about the use of the retirement plan as a learning activity. Several students responded that they really liked the activity. Several students said they would have liked more in-depth instruction regarding the use of EXCEL spreadsheets. Comments from students also indicated they thought the project due date should be earlier in the quarter to separate it from the team project and other end-of-quarter obligations.

Learning Strategy #2: Collaborative learning and building a learning community. Collaborative learning is a proven strategy for engaging students in learning and keeping them accountable. It also embodies constructivist theory through experiential learning and using real-world contexts 4.

Learning Activity #2: From an on-line survey assignment completed during the first week, each student identified an "area of practical application covered" that was important to them (e.g., lease vs. purchase a car). From those responses, students were grouped into small teams of 3-6 students each to complete a project related to their objective that requires the knowledge learned from the first three components of the class. Activities of the team included: 3,5

1. Getting organized and assigning roles (personality and team role assessment). 6

2. Creating a scenario for their project (e.g., purchase or lease a new Toyota Camry).

3. Gathering relevant data (costs, trade values, interest rates, resale values, gasoline mileage, maintenance costs, extended warranty, inflation rate, etc.)

4. Creating an analysis model using EXCEL (e.g., determine equivalent uniform annual cost)

5. Analyzing alternatives and perform sensitivity analysis

6. Searching the Web for sites that provide analysis tools for the situation being analyzed (e.g., LendingTree.com). 7

7. Comparing the group's analysis to those of websites found. Create a "webliography" that can be uploaded to a course web site that recommends sites for students to access and use after they graduate.

8. Creating and delivering a PowerPoint presentation for the class that summarizes their project scenario and highlights recommended web sites.

Team Dynamics: Each team member had a secondary role as an organizer (or "facilitator"), technician, or summarizer. These roles helped prevent the team from getting bogged down. Organizers keep people on schedule and follow-up to make sure the team stays on schedule. The summarizers communicate with the instructor on a regular basis and make sure that the results are understandable. The technicians are the experts with technology (e.g., PowerPoint, WebCT, HTML, etc.) being used and make sure that obstacles are overcome that may be slowing the team down. 6 A team web page was created with team pictures and role assignments. This was very useful to both students and the instructor for matching names with faces.

Results of Learning Activity 2: Student teams performed well although about half of the teams had one or two members who were non-contributors. A team member assessment survey was given that identified those individuals. This process should be done at the beginning or middle of the project as well as at the end to prevent some team members from slacking and give the instructor time to intervene if appropriate. Another idea is to have each team do a very brief project after they first get organized to help assess strengths and weaknesses and who the non-participants might be. The project could be putting together a PowerPoint presentation introducing their team and their project proposal.

Testing: Testing consisted of six on-line quizzes in WebCT. Quizzes generally consisted of 15 multiple choice/true-false questions. Two quizzes were administered "in-class" under direct supervision. Four quizzes were taken by students remotely at a pre-determined time. For most questions a bank of 2-5 questions was created from which WebCT would randomly choose one for the quiz. This produced unique quizzes for each student and reduced the impact of cheating (note: the topic of cheating is discussed in the "Conclusions and Recommendations" section at the end). Each quiz covered approximately two chapters of material from the book. Students were allowed to drop their lowest quiz.

Each quiz was preceded with a "practice" quiz option. The practice quizzes are important because the students need to get familiar with the quiz tool in WebCT and prepare for the types of calculations that will be thrown at them on the quiz. Prior to WebCT, the quizzes were almost always the same format as the homework problems. For on-line courses this similarity is usually not the case.

Practice quizzes consisted of 5 or 6 multiple choice/true false questions taken from or equivalent to some of the quiz questions and were available for two days before the real quiz. Students could see comments to each question they missed on the practice quiz and could retake it up to three times. A simple linear regression was done to compare actual quiz results to practice quiz results. There was a positive correlation between practice and real quiz scores with a $r^2 = 0.34$ ($n = 27$).

In two cases out of six, quiz results were extremely poor. This was attributed to a combination of circumstances which included unclear expectations or misleading practice quizzes. Students were given the option to retake these two quizzes and the higher of the two scores used (the ability to retake a quiz and use the higher score is an option within WebCT). The general result was that the better students improved their score substantially on the retake, while the poorer students only noticed minor improvements. Overall the retakes were considered helpful.

Part 4: Strengths and Weaknesses of the WebCT Course Management System

There are a variety of web-based course management systems available and side-by-side comparisons are available in the literature and on the Web. Cal Poly Pomona has adopted WebCT as a campus supported course management system. This presentation will limit itself to experiences with WebCT.

Advantages of WebCT

1. WebCT offers a lot of features that can be used to manage an on-line course. Some of these features include:

    - A public page to advertise the course or display course information
    - Instructors can structure their course in many ways. Assignments can be listed via syllabus, calendar, or assignment pages.
    - There are many communications options available for the instructor, students, and teams. Email, discussion boards, team work areas, white board, and chat rooms are available. WebCT email can be automatically forwarded to personal email accounts.
    - Students can upload work to the WebCT server for grading or class display. Instructors can open work for viewing and grading without having to download or print.
    - Grades can be automatically displayed for student assignments and in the grade book.
    - A grade book is available with the capability of showing calculated grades and letter grades.
    - Quizzes, tests, and surveys can be conducted on line. Quiz timing and delivery options can be used to reduce risk of student cheating. There are many options available to provide student feedback on missed answers.
    - Banks of test or quiz questions can be developed so that randomly generated quizzes can be given to reduce cheating (Note: WebCT has provisions for randomly choosing questions from banks of questions prepared ahead of time. However, it does not have a feature for randomizing responses within a multiple choice or matching question).
    - Quizzes can be validated. This is one of the nicer features of WebCT. Each question is analyzed to show the correct response rate for the top 25% and bottom 25% of the performers on the quiz. If the top performers score significantly lower on a particular question, there is usually a problem with the question or an error with the instructor's answer key. Changes made by the instructor result in automatic re-scoring of the quiz.
    - A glossary is available that can be used for the course.

- Students can build their own web page for the class.
- Instructor generally has many options for releasing pages and limiting accessibility within the course web site.
- Creating and modifying the class roster is fairly easy

2. Students can access course materials as long as they have access to the web. They can use the learning and communications tools that best suit their learning style.
3. Once a website is built and functioning well, it can be modified and reused for future classes.

Disadvantages of WebCT.

1. The author's biggest complaint with WebCT v3.6 is the antiquated input and output procedures. Multiple point-and-click strokes are required to complete even the smallest task. All of this results in a very long, annoying learning curve.
2. Because WebCT is web-based, the response delay that accompanies input and output over the Web is experienced between each point-and-click command. When connectivity is slow, these delays can be aggravating.
3. Knowledge of HTML is almost a must. To insert links, put spaces between lines, or bold headings or words on most WebCT pages requires inserting HTML codes.
4. The grade book is very difficult to manage and is not anything like a spreadsheet. Managing data takes about five times longer than with a comparable spreadsheet. The instructor has the ability to override some data fields when the need arises, but not others. This inability to correct mistakes or input grades by hand for assignments that were submitted late is one of the biggest design flaws of WebCT.
5. Aesthetically designing a course is not easy. The color scheme options are not very attractive and customizing is awkward.
6. Using WebCT requires a knack for using software and patience for figuring out how to do things.
7. Constructing tests and quizzes within WebCT is extremely cumbersome. However, a software package called Respondus is available that can be used to quickly develop banks of test questions and upload them to WebCT. Respondus has a "Lite" version that is free. Our campus has a site license to the full version, which includes an equation editor. Editing quizzes can be very frustrating because the software does not always function the way you expect it should.

Part 5: Findings, Conclusions, and Recommendations

On-line teaching and engineering economics - Engineering economics is the kind of course that can be successfully taught on-line if sufficient learning options are available and students get engaged in the course through projects of interest and team activities. Web resources abound and teaching materials are not hard to prepare if the instructor is willing to put in the time. It is the author's opinion that a hybrid course lends itself very nicely to teaching engineering economics with the recommendation that 25% to 50% of classes be face-to-face.

WebCT - WebCT has a very long learning curve and it is very time consuming to develop a course. Based on the author's experience, the following three-term sequence of personal growth and course development is HIGHLY recommended as a minimum pace for going on-line.

Quarter/Semester 1 - Prior to ever teaching an on-line course, experience being an on-line student. Preferably find and take an on-line course that uses WebCT. Being an on-line student is an invaluable eye-opening experience.

Quarter/Semester 2 - If possible, take a course in how to use WebCT. Use WebCT course management tools in a traditional face-to-face class to develop a public page, syllabus, and/or calendar, quizzes/tests, and other resource pages.

Quarter/Semester 3 - Teach a hybrid on-line course. Develop instructional materials concurrently. Release time of some sort is almost a must.

There is not enough time in a quarter or semester to do it any faster unless you have significant release time and/or student assistants to do some of the work.

Measurable results - The IME Department developed and uses a course assessment instrument that consists of two parts: Instructional Assessment and Outcomes assessment. Instructional Assessment consists questions 1-10 related to the instructor's management of the course. For outcomes assessment developed as part of ABET 2000, the IME Department at Cal Poly Pomona identified 25 knowledge, skill, ability and attitude (KSAA) areas that are important to our stakeholders. These 25 KSAAs were prioritized and the top seven KSAAs were included as "outcomes" assessment questions 11 - 17 on the instrument. The same instrument was used to assess the EGR 403 course in three successive quarters. Each quarter used progressively more on-line technology as explained below:

Spring 2002: Continuum Level 1-2 - Conventional delivery of course content. Conventional Web pages used to display assignments. One small project assignment given to discover and evaluate Web resources. No team assignment given.

Fall 2002: Continuum Level 3-4 - Conventional delivery of course content. WebCT used to organize course materials. Students divided into teams and were allowed to use WebCT communication tools.

Winter 2003: Continuum Level 8 - Hybrid course under WebCT with 80% of course on-line including delivery of course content.

Table 3 shows the results of these assessments. A weighted score is shown based on the following scale: 1 = Very Good, 2 = Good, 3 = Satisfactory, 4 = Poor, 5 = Very Poor.

Table 3 - Results of Program Assessment for EGR 403

Survey Item	**Instructional Assessment**	Spr 02 (n = 65)	Fall 02 (n = 54)	Win 03 (n = 27)
1	How effectively does the instructor organize and structure the course?	1.33	1.69**	1.58*
2	How well does the instructor define and meet objectives of the course?	1.32	1.70**	1.76*
3	How well does the instructor arouse interest and transmit knowledge of the subject?	1.55	1.89	2.04*
4	How well does the instructor demonstrate knowledge of the subject?	1.26	1.54*	1.58*
5	How well does the instructor answer student questions?	1.34	1.57	1.71*
6	How effectively are the board and other visual aids used?	1.58	1.87	1.68
7	How available is the instructor to students for consultation?	1.63	1.68	1.61
8	How well was the course material paced?	1.54	1.83*	2.16**
9	How accurately does the instructor's grading reflect what the student has learned?	1.69	1.94	2.12*
10	How would you rate this instructor compared to other instructors?	1.40	1.58*	1.88**
	Outcomes Assessment Skill, Knowledge, Ability or Attitude Area			
11	How would you rate your ability to apply what you learned from this course?	1.75 (n = 60)	1.81 (n = 52)	2.08 (n = 25)
12	How would you rate the improvement in your ability to identify and solve problems based on your experience in this course?	1.82 (n = 61)	1.92 (n = 51)	1.88 (n = 26)
13	How would you assess the value of what you learned from this course when seeking a job?	1.90 (n = 61)	1.90 (n = 49)	2.08 (n = 24)
14	How would you assess your improvement in engineering skills (e.g., CAD, programming, data analysis, CNC, use of software, use of scientific equipment, finding technical information, etc.)?	2.08 (n = 36)	2.30 (n = 37)	2.08 (n -= 13)
15	How would you assess the coverage of issues related to professional behavior and ethics in this course?	1.91 (n = 47)	2.13 (n = 38)	1.93 (n = 15)
16	How would you assess your improvement in communications skills (either written or oral) from your experience in this course?	2.15 (n = 40)	1.98 (n = 45)	2.00 (n = 20)
17	How would you assess your improvement in teamwork skills from your experience in this course?	1.95 (n = 19)	1.98 (n = 50)	2.17 (n = 24)

Note: * = Chi-Square test significant at 0.05 level, ** = Chi-Square test significant at 0.01 level

A comparison of the instructional assessment results between the traditional course (Spring 2002) and the WebCT assisted course (Fall 2002) showed decreases in every category. These decreases were significant at the 0.05 level for questions 4, 8 and 10. The decreases were significant at the

0.01 level for questions 1 and 2. The decreases are attributed to two major factors: (1) The addition of WebCT (and subsequent learning curve of both the students and the instructor), and (2) the addition of a team project to the course.

The outcome assessment results (questions 11-17) between the traditional course (Spring 2002) and the WebCT assisted course (Fall 2002) showed no significantly different results using the Chi-Square test. There was no team project in Spring 2002 which explains why only 31% of students responded to Question 17 compared to 96% who responded in Fall 2002.

A comparison of the instructional assessment results (questions 1-10) between the traditional course (Spring 2002) and the hybrid WebCT course (Winter 2003) showed a decrease in 9 of the 10 questions. Questions 1, 2, 3, 4, 5, and 9 showed decreases significant at the 0.05 level. Questions 8 and 10 showed decreases significant at the 0.01 level. There was a slight, but insignificant improvement for question 7 regarding how available the instructor was for students. This made sense because most students got fast response to email messages and phone calls. These further decreases are speculated to be due to structural issues and the lack of personal contact with students. The author has traditionally been highly rated by students in upper division classes, so these significant decreases are not random variations.

The outcome assessment results (questions 11-17) between the traditional course (Spring 2002) and the hybrid WebCT course (Winter 2003) also showed no significantly different results using the Chi-Square test. While not significant, the teamwork experience showed a decrease in assessed value of the learning experience. Of the six team projects conducted in the hybrid course, two teams seemed to function very well with projects they were engaged in. Three teams produced good results, but had at least one or two team members who were non-contributors. One team was a disaster and those students had very negative experiences.

Analysis of instructional and outcomes assessment results - The literature talks about the role of the instructor changing from the "sage on the stage" to the "guide on the side". As the focus is taken away from the instructor and placed on the technology, the instructor's importance and comparative value is diminished in the eyes of the students.

Learning results - Hypothesis tests were used to compare quiz, homework, and overall grade results between the Fall 2002 classes and the Winter 2003 class. There were no significant differences in those results. It was observed, however, that four students in the hybrid class (Winter 2003) did rather poorly. It is conjectured that there will likely be students in on-line classes that suffer when they do not have the discipline and structure of a traditional course to keep them moving along. When some of these students were asked why they had not completed assignments or taken a quiz they replied, "I got busy and forgot," or "I didn't check my email for a week."

It is the author's opinion, however, from grading homework and the projects, that the students master the material better in the hybrid course. The use of EXCEL functions for homework and project forced the students to understand the material at a higher level even though it was not reflected in the measures used to evaluate results. It is also the opinion of the author that even

though four students did not do very well, the lower end of the class on the whole did much better than with previous teaching formats.

Other issues, observations and concerns:

Cheating - It is very difficult to design an on-line course that is fool-proof to cheating when students are localized. At best cheating can be minimized. Since a hybrid class was undertaken, a number of quizzes were given under controlled conditions during the few class meetings that were held. This allowed the instructor to see which students, if any, were cheating or significantly deficient in their actual knowledge. While there was some indication of collaboration on the first on-line quiz in Fall 2002, changing the time-frame allowed and how questions were delivered via WebCT seemed to minimize the situation. Also, for almost every quiz question, two to five alternative questions were created as a bank for WebCT to randomly select questions from. This practice created unique quizzes and, in the suspected cases of collaboration, resulted in low scores by the cheaters. (Note: the collaboration was detected based on the elapsed time recorded by WebCT for taking the quiz. Several students completed their quizzes on-line in six minutes. This was only enough time to enter pre-determined answers and much less than the 35 minutes allowed.).

Recommendation: If a hybrid course is 25% - 50% face-to-face, use part of that time to give quizzes or exams under controlled conditions in a computer lab. This eliminates the ability to collaborate as well as for students to "screen-save" the quiz for future students to use.

Structure: As literature about on-line teaching warns, students need to have structure and clarity in order to stay on track and remain accountable. This author's experience only confirms that. When some students are not forced to go to class several times a week, they forget about the course and/or procrastinate. These students need to be held accountable from the very beginning to deadlines and team commitments to make sure they do not get too far out of line with their coursework. Likewise, it is the instructor's responsibility to prepare materials for on-line use that are clear, easy-to-use, and sensitive to varying learning styles. Not only do students need to understand the course material, but they also need to understand the on-line technology environment they using. This added knowledge requirement can be easily overlooked and create problems for both the student and the instructor.

Annotated Web Resources:

The following web sites were found and used in the development of the on-line strategy and course materials:

http://www.bloomberg.com/money/tools/bfglosa.html
A very comprehensive financial glossary that students can use to look up new terms used in the course. Terminology is a very important part of the course.

http://www.getobjects.com/Components/Finance/TVM/index.html
Web site with clear explanations of the principles of the course. Good resource for some of the

more technical aspects.

http://www.public.iastate.edu/~inde304/homepage.html
A very comprehensive course web site.

http://www2.ncsu.edu/unity/lockers/users/f/felder/public/ILSdir/ilsweb.html
Great web site about learning styles with on-line survey, analysis information, and other references.

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Biography

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