

MARCOECONOMICS 1010

A Report on Technology-Enhancements in a First-year Course

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Abstract

This study evaluated the usefulness to students of technology enhancements in a large lecture macroeconomics course for first-year students at York University. The professor posted RealAudio files of every lecture, plus whiteboard images, PPT slides, lecture notes, and even something called Watch & Listen where the RealAudio, PPT and whiteboard images loaded automatically in sequence in RealPlayer. WebCT was used for online discussions, but the online discussion was voluntary, and there was little participation. Most of the data came from an online survey and web server log files, but we also analyzed the transcript of a focus group and the text from an online discussion thread devoted to the technology enhancements in the course. Log file analysis showed an extraordinary amount of activity by students, and the few students who did not access the website were among the poorest achievers. Students were very positive about being able to access the lecture materials anytime, from any place, and especially at any pace. There were no significant challenges to students in accessing or learning to use the software required for this course.

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Table of Contents

ECON 1010 Report.....	i
Abstract.....	ii
Acknowledgements.....	iii
Table of Contents.....	iv
Introduction.....	1
Description of ECON 1010 Course Technology	1
Research Methods.....	6
Reliability of web server statistics.....	9
Flashlight Survey Results	10
WebCT Server Log File Analysis.....	14
Student activity.....	16
Student navigation patterns.....	18
Student conduct in general.....	19
Student conduct related to class lectures.....	20
Student conduct related to old tests.....	22
Class interactions in WebCT.....	23
Student achievement and web server activity.....	24
Qualitative Analysis of Textual Data.....	26
Conclusions.....	32
References.....	33

Introduction

Professor Avi Cohen had a comprehensive web site to support a traditional lecture based macroeconomics course. The ECON 1010 course also had a large enrolment; 444 students received a final grade for the course. The ECON 1010 course website was considerably more sophisticated than many course websites. In addition to the standard course web pages, such as a class schedule, announcements, contact information, etc., this site had a discussion board, full audio of every lecture, the PowerPoint slides that accompanied the lecture, as well as whiteboard images of any content presented during class. The course website was located on York University's WebCT server so that class and study group discussions could also be conducted online.

This study investigated to what extent and how students took advantage of the resources made available to them at this comprehensive course website. We looked at what kinds of resources students accessed most often, as well as resources students did not tap by analyzing web server log files. We also asked students their perceptions of the technology used in Dr. Cohen's class, and these data complemented the web server log files that reported actual student usage patterns. Finally, we examined the relationship, if any, between student use of the website and student achievement in the course.

Description of ECON 1010 Course Technology

Professor Cohen's class is held three times a week for one hour in a large lecture hall. Because the class contained, at least initially, over 500 students, there was less opportunity for individual students to interact during the one-hour lectures. In an effort to increase student access to course resources, Dr. Cohen made many course materials for ECON 1010 available within WebCT for the winter 2001 term. Prior to the winter 2001 semester, Professor Cohen had a course website with very similar resources. However, he moved the course to WebCT in winter 2001 semester so that online discussions in

both small and large groups could be included as part of the course technology available to students.

Student assessments for ECON 1010 consisted of two tests, and one final exam. The tests and exams were predominately multiple-choice questions, but also included a few problems for which solutions had to be submitted. Students were encouraged to work in study groups, and work through problems from the textbook but this was not a course requirement.

Students who accessed WebCT were required to login to WebCT with a username (York University or yu number) and a password. Here is a screen shot of the WebCT course home page:

The screenshot shows a web browser window with the address bar displaying http://webct.yorku.ca/SCRIPT/AS_ECON_W_1010_3_C_EN_A_LECT_01/scripts/serve_home. The page header includes the York University logo and navigation links: MYWEBCT | RESUME COURSE | COURSE MAP | HELP. The main content area is titled 'Introduction to Macroeconomics' and 'Home'. A large, stylized 'Learning' title is followed by the quote: 'Learning is not a spectator sport. Learning is not downloading. Learning requires engagement and interaction. To learn economics, you must do economics... Participate in class. Work through problems. Join a study group. Ask questions.' The word 'economics' is written in a large, bold, blue font at the bottom.

Figure 1. ECON 1010 Home Page.

The welcome message informs students about Dr. Cohen's approach to teaching and learning. This constructivist view of education, where learning is seen as an active process, is also reflected in the choice of a theoretical framework we used to evaluate the

qualitative materials in this study (Murphy, 1997). The framework will be described in detail later in this paper.

After students logged in and scrolled down the home page screen, there appeared a series of buttons that represented the menu choices for the course. These menu choices were also available in text only under Course Menu on the left hand frame within the browser window (see Figure 1). Figure 2 shows an image of the main menu buttons on the home page:

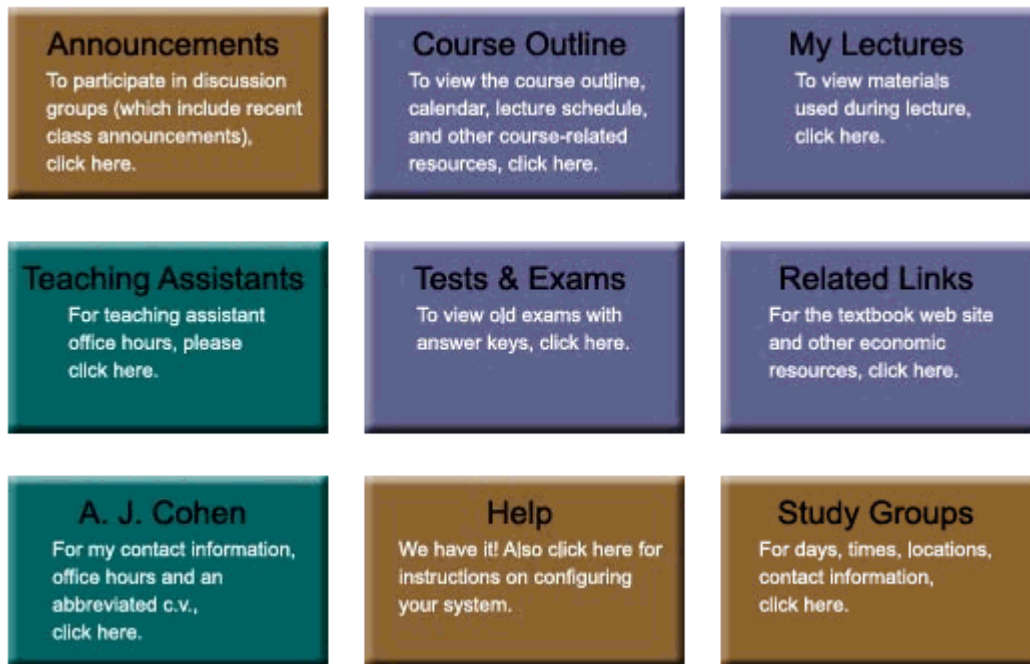


Figure 2. Clickable buttons representing main menu choices for ECON 1010.

Most of the main menu items listed in Figure 2 seem self-explanatory, but here is a further description of specific pages or directories as shown in Figure 2:

- **Announcements** (see next paragraph for the description).
- **Course Outline** (/course_info/) – this was a directory with links to the lecture schedule and assignments, texts and readings, composition of final grade, course work, make-up policy, drop dates, religious observance policy, academic honesty, and a print friendly version of the course outline.
- **My Lectures** (mylectures.html) – this page contained a table with links to five different files students could access for each lecture during the entire semester.

Here is a list of the five files, the actions available to students, and when the files were usually posted on the website and available for download:

1. download or view the PowerPoint slides, posted one day before lecture.
2. print the PDF lecture notes, posted one day before lecture.
3. print the PDF whiteboard files, posted one day after the lecture.
4. listen to the RealAudio files, posted the same day just after the lecture.
5. invoke the Watch and Listen feature, posted three or more days after the lecture.

A whiteboard file contains text and graphical images (such as, a supply and demand curve) drawn by Professor Cohen during the actual lecture, and saved in PDF format after the lecture. Clicking on the Watch and Listen link launched RealPlayer and a browser window to view the PowerPoint slides and whiteboards simultaneously; the slides and whiteboards advanced automatically while the student listened to the RealAudio lecture. RealAudio files and whiteboard images were uploaded within 24 hours of the lecture; the Watch & Listen files were not available for XX days after the lecture was delivered. The lecture notes and PowerPoint slides were available before the lecture.


- **Teaching Assistants** (ta.html) – this page had a table listing the Teaching Assistant’s name, and the day and time they were available in the office.
- **Tests & Exams** (/tests_and_exams/) – this was a directory with links to previous tests, exams and answers, test and exam protocols, and the test make-up policy.
- **Related Links** (related_links.html) – this page had links to the textbook’s website, other York sites, and other subject related sites, including one humorous website.
- **A. J. Cohen** (/avi_cohen/) – this directory contained links about office hours, abbreviated curriculum vitae, teaching and research, and how to contact Professor Cohen (contact_me.html); the contact_me.html page also had a form where students could submit anonymous feedback to the professor.
- **Help & Configuring** (help_and_conf.html) – this page had links and information about contacting Computer Services’ Help Desk, getting WebCT Help and about

installing required software, such as, RealAudio Player, Adobe Acrobat Reader, and PowerPoint Viewer.

- **Study Groups** (studygroups.html) – this page included details about each study group’s meeting time, members and coordinator’s name.

In order to explain the Announcements area in WebCT, here is a screen shot of the discussion board for ECON 1010:

Introduction to Macroeconomics
[Home](#) » [Announcements](#)

 **Select a topic to see its messages**

[Compose Message](#)
[Search](#)

Topic	Unread	Total	Status
All	0	216	
Announcements	0	37	public, locked
Main	0	179	public, unlocked
Notes	0	0	public, unlocked

Figure 3. Entry point for discussion areas in WebCT.

The Announcements topic area was locked, which means that only Dr. Cohen posted messages to this topic. This practice has been shown to help students manage the abundance of course information available on a course website by creating a separate area for teacher authored messages (Young, 1999). The Main discussion area was not locked, and students could post messages freely to this topic. Anonymous posting is possible in WebCT, but was not enabled for ECON 1010. As previously noted, anonymous feedback to the professor was available from the contact_me.html page. The Notes area, a standard feature in WebCT, was not used and unfortunately could not be removed from the discussion board page.

Research Methods

Many authors agree that different and complementary research strategies should be used when evaluating technology enhanced learning environments (Haertel & Means, 2001). It is especially worthwhile to mix quantitative and qualitative methods when evaluating web-based learning (Owston, 1999). Using a variety of methods provides opportunities for triangulation because data from different sources are combined for the purpose of improving inferences from the combined data sources (Patton, 1990). Mathison (1988) states that one assumption about triangulation is that bias is somehow cancelled out when using a variety of sources and methods. Triangulation helps the researcher find evidence that may make sense of a social phenomenon, but triangulation strategy does not do this on its own. The real reason for triangulating is not for technical validation, but to make the researcher accountable for explanations of the phenomenon under investigation.

Thus, we used a number of different ways to help answer the research questions. First, we asked students to complete a voluntary online survey form. The online survey was derived from the Flashlight™ Current Student Inventory. Second, we obtained the log files from the WebCT server for the entire semester. The log files were analyzed using WebTrends' Log Analyzer 6.0 (NA, 1999). Statistics about student activity on the WebCT server were also gathered using WebCT's own internal tracking devices. Also, students' grades were correlated with web server usage statistics. Finally, a focus group session with four student volunteers was audio-recorded, and transcribed. Text materials from the focus group transcript, from the open-ended survey questions, and from a WebCT discussion thread were analyzed using qualitative data analysis software (Atlas.ti).

The survey instrument developed for this research report used the Flashlight™ Current Student Inventory (CSI) as the starting point for item selection and composition. The Flashlight™ Project is a non-profit corporation affiliated with the American Association for Higher Education (AAHE), and this project group has been developing

survey questions and interview guides since 1994 [NA, ND #13]. The Flashlight™ CSI was developed because it was known that many different sorts of educational institutions use technology for the same reasons, and also have the same concerns about using technology. Currently the student inventory contains 500 pre-tested items. Content validity was established during an 18-month series of focus groups with participants, faculty and administrators. The database also contains items about teaching and learning that have nothing to do with technology. An educational issues subscale index helps guide item selection (see Table 1 below). Questions can be completely customized, and new questions created, so it is not compulsory to rely solely on items in the database. Once all items are selected they can be made available to respondents on the Web.

The online student survey for the ECON 1010 course consisted of 33 items: 26 Likert type questions, five demographic questions and two open-ended questions. Completion of the survey was voluntary, however, a small incentive was used; three students were randomly picked from the list of respondents and awarded either one cash prize of \$100, or one of two prizes worth \$75 dollars. Twenty-seven items were chosen from the Flashlight database, and six, including three demographic items, were developed specifically for this course. The survey was hosted on the Flashlight™ server, and is available online at this URL: <http://wwwctl.wsu.edu/CTLSilhouette/surveys/ZS3354> (see also Appendix A). The final survey given to students was developed from several drafts; each draft was revised after feedback from Office of Technology Enhanced Learning (oTEL) staff and Dr. Cohen.

The ECON 1010 survey items were mapped to an educational issues subscale index that serves as a theoretical basis for items in the Flashlight™ tool kit. The ECON 1010 survey also contained six negatively worded Likert items. Table 1 provides a summary of the ECON 1010 survey items in terms of the Flashlight™ Educational Issues Subscale Index.

Table 1
Flashlight™ Subscale Codes

Flashlight™ Code	Description of Code	Number of items in ECON 1010 survey
A	Active learning	4
C	Collaborative learning and other forms of student	4

Flashlight™ Code	Description of Code	Number of items in ECON 1010 survey
	interaction	
D	Using time productively	3
E	High expectations for all participants regardless of learning style	3
F	Rich and rapid feedback	1
G	Engagement in learning	1
I	Faculty-student interaction	4
N	Cognitive and creative outcomes (including encouraging creativity)	3
O	Accessibility	2
P	Positive addiction to technology	1
S	Prerequisites for using technology (technical skill deficiencies)	1
T	Time on task	1
U	Respect for diversity	0
X	Application to "real world" problems/preparation for work	0

The Flashlight Educational Issues Subscale is based on seven principles for good practice in undergraduate education, originally published in an AAHE Bulletin (Chickering & Gamson, 1987). Not only does the educational issues subscale serve as a theoretical basis for development of the online survey, the scale also formed the foundation for coding text materials from the focus group, open-ended survey questions and a WebCT discussion thread devoted to course feedback. Even though the seven principles were developed before the advent of the World Wide Web, they are still used by researchers today to evaluate online courses (Graham, Cagiltay, Craner, Lim, & Duffy, 2001). Here is a list of the seven principles of good practice:

1. encourages student-faculty contact.
2. encourages cooperation among students.
3. encourages active learning.
4. gives prompt feedback.
5. emphasizes time on task.
6. communicates high expectations.
7. respects diverse talents and ways of learning (Graham et al., 2001).

The use of this framework to examine the technology and teaching practices in the ECON 1010 course gave us a practical and a theoretical foundation for this evaluation. Finally,

the principles of good practice are aligned with Professor Cohen's philosophy as can be seen in the welcome message to his course (see Figure 1).

The qualitative text materials that were analyzed included the results from two open-ended questions in the Flashlight survey, the text of a WebCT discussion thread where students were asked to comment specifically about the technology used in the course, and the transcript of a focus group. Only one focus group was formed even though incentives were offered to students. The timing of a focus group session was difficult to plan because the course ended just before the summer holiday, and many students were no longer coming to campus once final exams were finished.

Reliability of web server statistics.

Although web server log files record web server activity quite reliably, there are many potential sources of error when analyzing web server log files (Haigh & Megarity, 1998). Caching by Internet Service Providers (ISPs) or a student's own browser may mean that the server will have no record of a particular web page being viewed. Log Analyzer reported about 21% of the web page hits as cached on the ECON 1010 site.

When a web browser sends a request for a web page, it may first ask the server if there is a newer version of the page on the server. If the latest version of the file is already in the browser's cache, this saves the server from actually sending the file. Because a header request was received, the web server "knows" that the requested file was cached. So known cached hits are those where the page was found in the cache of the browser, and the server did not need to transfer the file. Unfortunately, most browsers are set by default to ask the web server for a newer version of a file only once per session, so there is still the potential for many pages to be loaded from a cache without the server log recording that the page was requested.

Caching also affects what Log Analyzer calls *Most Requested Pages* because the first file logged by the server could very well be in the middle of the user's visit. Search robots and spiders can also be a source of error because they add to the total hits, but fortunately, spiders and robots cannot access web pages that require a login. The web

server log files did not record the referrer field, however, this lack of information did not affect the ECON 1010 log analysis because all logins were authenticated on WebCT.

Because all logins to the ECON 1010 web server were authenticated many common sources of error in server log file analysis were precluded. For example, there is really no way to tell precisely how many visitor sessions a non-authenticated website has because one user can appear to connect from multiple hosts if the user's ISP uses a proxy server or firewall (del Campo, 1999). However, total visitor sessions can still be miscounted even with authenticated logins because one user can appear to be coming from one IP address for the text on a web page, and from a second IP address when an image is loaded. Requests for an image file are not authenticated. In this situation, Log Analyzer will count two sessions even though it is the same individual.

Finally, log analysis can't accurately tell how many visits there are to a site because a visitor session is defined as a visit from one host over a 30-minute period (Goldberg, nd). As previously explained, it cannot be assumed that a host or IP number corresponds to one individual, nor that the individual would not pause or go to another site for longer than 30 minutes. What is defined as a "visitor session" is at best an estimate.

Flashlight Survey Results

The results for each Likert item in the Flashlight™ survey are listed in Table 2 below. There were a total of 155 respondents, but one respondent only completed a few items in the survey. With 444 students finishing the course, this was about a 35% response rate. Questions that do not have an educational issue listed were custom made questions that were not part of the Flashlight™ Current Student Inventory. Questions 1-11 and 20-26 were based on a 5-point Likert scale, and questions 12-19 were based on a 6-point Likert scale. For the 5-point Likert scale, the value for a *strongly agree* response was 1, for an *agree* response was 2, for a *disagree* response was 3, and for a *strongly disagree* response was 4. Thus, a lower score indicates stronger agreement. Similarly for the 6-point Likert scales. The only exception to this reverse scoring was for question 1,

2, and 3 where stronger agreement gave higher rather than lower values. Values for “not applicable” responses on the Likert scales were removed from the mean and standard deviation calculations. To view the full text for each question, please refer to Appendix A.

Table 2

Results of ECON 1010 Flashlight™ Survey

Question	Flashlight educational issue	Mean	Standard Deviation	Likert Scale	Comments
1. Encouraging students to take responsibility for their own learning	A – active learning E – high expectations	4.14	0.93	5 point (↑ value = ↑ agreement)	strong support -- 65 respondents gave this the highest possible rating.
2. Building students' confidence in their ability to learn difficult subject matter.	E – high expectations for all students	3.69	0.90	5 point	fair support for this statement
3. Encouraging meaningful communication between the instructor and students.	I – faculty-student interaction	3.96	1.00	5 point	strong support – 109 respondents rated this a 4 or 5
4. I am more comfortable participating in discussions in this course, than I am in other courses.	A – active learning I – faculty-student interaction	2.41	0.83	5 point (↓ value = ↑ agreement for remaining items)	mixed response, but 79 students agreed or strongly agreed
5. The emphasis on working in groups in this course has helped me to understand the ideas and concepts being taught.	C – collaborative learning	2.21	0.82	5 point	50 respondents rated this item not applicable, but 70 students agreed or strongly agreed
6. I looked forward to working on assignments for this course.	G – engagement in learning	2.16	0.77	5 point	44 respondents rated this item not applicable possibly because there were no graded assignments required
7. This course helped me learn to work through a process to solve problems.	N – cognitive and creative outcomes	1.85	0.62	5 point	strong support – 133 respondents agreed or strongly agreed

Question	Flashlight educational issue	Mean	Standard Deviation	Likert Scale	Comments
8. Assignments for this course encouraged me to exercise my creativity.	E – high expectations N – cognitive and creative outcomes	2.32	0.80	5 point	54 students rated this item not applicable.
9. The instructional/directional information supplied in this course was vague and/or incomplete.		3.61	0.60		139 students disagreed or strongly disagreed with this statement
10. The tests for this course reflected whether I achieved the stated learning outcomes.		1.95	0.81	5 point	strong support – 122 students agreed or strongly agreed
11. I am more interested in activities that involve the use of a computer.	P – positive addiction to technology	2.02	0.82	5 point	very good support – 110 students agreed or strongly agreed
12. ...discuss the ideas and concepts taught in this course with other students.	C – collaborative learning	2.53	1.05	6 point	mixed response with only one student rating item not applicable
13. ...learn from comments made by the instructor for this course.	F – rich and rapid feedback I – faculty-student interaction	1.95	0.85	6 point	very good support – 115 students selected “much more likely” or “somewhat more likely”
14. ...ask other students for comments on your course work.	C – collaborative learning	2.76	1.01	6 point	mixed response – 18 students rated item not applicable, and 56 students selected “about the same”
15. ...put more thought into my comments.	A – active learning	2.38	0.96	6 point	80 students selected “much more likely” or “somewhat more likely”
16. ...feel more comfortable asking an awkward question.	A – active learning I – faculty-student interaction	2.53	1.17	6 point	81 students selected “much more likely” or “somewhat more likely”
17. ...find it more difficult to relate to the other students in this class.	C – collaborative learning	3.44	0.97	6 point	small trend toward “less likely” ratings
18. ...waste too much time sorting through my messages to find the	D – using time productively	3.51	1.24	6 point	fairly mixed response, although 74

Question	Flashlight educational issue	Mean	Standard Deviation	Likert Scale	Comments
few that are useful.					students selected "somewhat less likely" or "much less likely"
19. ...find it easier to juggle my course work with my work and/or home responsibilities.	D – using time productively O -- accessibility	2.37	1.16	6 point	good support – 83 students selected "much more likely" or "somewhat more likely"
20. ...I must usually wait a long time to use a computer.	O -- accessibility	3.44	0.70	5 point	135 students disagreed or strongly disagreed
21. ...I am at a disadvantage because I do not possess adequate computer skills.	S – prerequisites for using technology	3.65	0.62	5 point	only 7 students agreed or strongly agreed with this statement
22. ...I spend more time studying.	T – time on task	2.35	0.81	5 point	small trend toward agreement
23. ...I am better able to visualize the ideas and concepts taught in this course.	N – cognitive and creative outcomes	1.70	0.65	5 point	strong support – 137 students agreed or strongly agreed
24. ...learning to use the software takes time away from learning the ideas and concepts for this course.	D – using time productively	3.48	0.68	5 point	139 students disagreed or strongly disagreed, indicating that students did not object to time spent learning to use WebCT
25. ...my requests to the WebCT Help line and/or calls to the Help Desk were promptly and satisfactorily resolved.		1.97	0.84	5 point	93 students found this item not applicable, but of those that did, there was good support (47 agreed and only 14 disagreed)
26. I would recommend this course to others.		1.44	0.61	5 point	93 students strongly agreed, and another 55 agreed. Only 5 students disagreed, and one selected not applicable.

Looking at the survey results overall, and in terms of the principles of good practice, a few themes are apparent. Students were positive about faculty-student

contact, and the opportunities for active learning in the ECON 1010 study groups. Active learning means engaging the learner with the content being learned in a way that involves students in doing things and thinking about what they are doing (Bonwell & Eison, 1991). Also, students did not indicate, in any significant numbers, problems with learning to use WebCT or gaining access to computers. However, collaborative learning was often viewed as Not Applicable even though Professor Cohen promoted the use of study groups. Although students appreciated the intellectual challenges in ECON 1010, there is some suggestion that the assessments, which were based on three exams, could be modified to respect more diverse talents and ways of learning. In general, the survey results were very positive, and the good response rate might also be an indication that students were motivated to report their experiences in ECON 1010.

WebCT Server Log File Analysis

Log files of the activity on the server hosting WebCT were saved and analyzed using Web Trends' Log Analyzer 6.0. The WebCT server produces some tracking statistics on its own, however, there is far more detail and flexibility in the reporting when using a commercially available log analyzer software package, such as Log Analyzer. The purpose of the log file analysis was to determine to what extent and how students used the WebCT website. Log analysis made it possible to determine what resources or web pages students accessed most often, as well as find out which web pages students did not access or accessed the least. Since students were required to log into the WebCT site, it was also possible to track an individual student's activity during the semester and for the time the log files were saved.

WebCT counts *Hits* much more conservatively than Log Analyzer (see definition of a Hit in Table 3 below). The average number of *Hits* per student according to WebCT was 122. Since WebCT does not count file downloads, the number of *Hits* does not reveal as much about student activity as Log Analyzer, especially in a course like ECON 1010 where the major activity was downloading various files.

The log file analysis will begin with a discussion of overall student activity, followed by student navigation within the site, and finally student behaviour related to various course resources. The log file analysis section will end with an examination of the reliability of web server statistics. Before proceeding to the analysis, readers unfamiliar with Web server terminology may wish to consult Table 3 for definitions of terms used.

Table 3

Definition of terms used in WebCT server log file analysis.

authentication	A technique by which access to Internet or Intranet resources requires the visitors to identify themselves by entering a username and password.
bandwidth	The measure in kilobytes of data transferred or the traffic on the site.
browser	A program used to locate and view HTML documents (for example, Netscape, or Microsoft Internet Explorer (IE).)
cache	A cache is a temporary storage location for regularly or recently accessed files, which are cached in an effort to improve performance. If a user's browser loads a web page, then leaves that first web page to go to another web page, and subsequently clicks the back button on the browser to return to the first page, chances are that the first web page will load much faster than when first retrieved. This is because a copy of the first page and all the graphics on that page were stored in the browser's cache. In other words, the browser doesn't have to wait for a web server to serve the page a second time because it's already on the user's hard disk. The amount of time that this first page will stay in the browser's cache depends on the browser's settings. Usually browsers are set to some default size. In Netscape and IE it is about 5000 bytes. Once that byte size is exceeded, the browser begins to empty the older files from the cache. Cached hits are those where the page was found in the cache of the browser, so the server did not need to transfer the file. The server knows a page is cached if the browser sends a 304 return code after a page is requested.
hit	Any action on the Web site, for example, when a visitor views a page or downloads a file. NB -- WebCT's definition of a hit is different than Log Analyzer's definition. A hit using WebCT's tracking tool does not include images, audio files, other downloaded files or pages served from the /scripts or /style directories. Log Analyzer counts any action as a hit, therefore, Log Analyzer hit counts tend to be much greater than WebCT counts.
IP address	Internet Protocol address identifying a computer connected to the Internet.
log file	A file created by a web or proxy server, which contains all of the access information regarding the activity on that server.
page views	Page views are a hit to HTML pages only (access to non-HTML documents are not counted).
server	A computer that hosts information available to anyone accessing the Internet.
visitor session	A session of activity (all hits) for one visitor of a web site. A unique

	visitor is determined by the IP address or cookie. A cookie is a message given to a web browser by a web server in the form of a text file. By default, a visitor session is terminated when a visitor is inactive for more than 30 minutes. This duration can be changed from General panel in the Options, Web Traffic Analysis dialog.
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Student activity.

The Log Analyzer software produced a report summarizing student activity during the entire semester -- February 26 to May 15, 2001. The course began on February 26, the last lecture was held on May 4, and the final exam took place on May 15. The period covered for the overall activity summary included log files from the beginning to the end of the semester, plus the week of the final exam. The section on Class Lectures will focus activity levels more specifically for certain time periods. Table 4 below shows the details of this overall activity summary for the whole semester.

Table 4
Outline of general server activity

Summary of Activity for Report Period	
Average Number of Visitor Sessions per day on Weekdays	236
Average Number of Hits per day on Weekdays	3,588
Average Number of Visitor Sessions for the entire Weekend	299
Average Number of Hits for the entire Weekend	3,640
Most Active Day of the Week	Monday
Least Active Day of the Week	Saturday
Most Active Day Ever	May 14, 2001
Number of Hits on Most Active Day	10,593
Least Active Day Ever	March 10, 2001
Number of Hits on Least Active Day	67
Most Active Hour of the Day	11:00-11:59 am
Least Active Hour of the Day	05:00-05:59 am

Note that the average number of hits and visitor sessions for the whole weekend and each weekday were very similar, even though Saturday was the least active day. The reason May 14th was the most active day was probably because the final exam was scheduled for May 15th. March 10th the least active day, and was only the second Saturday after the start of the semester. At this point in the term, using the course

website was still relatively new to students. In fact, 256 of the 444 students did not even login for the first time until March.

Students were active on the website 24 hours a day. Even though 5 to 6 am was the least active hour reported, there was still considerable activity even during the wee hours of the morning. Figure 4 shows an activity summary based on the hour of the day.

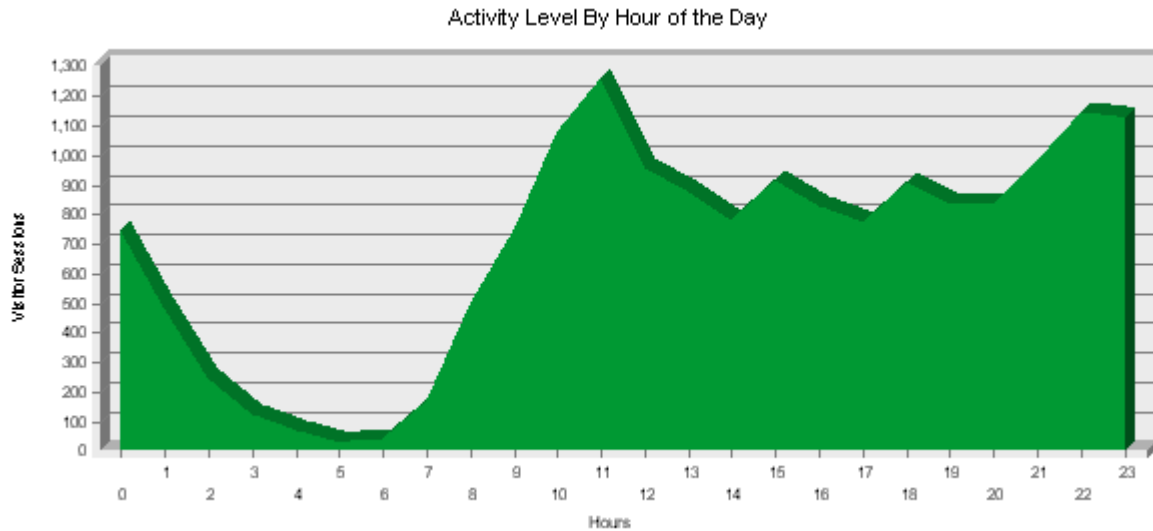


Figure 4. WebCT server hits graphed by hour of the day.

It is also worth noting that activity peaked in the late morning, right before the scheduled lectures from 12:30 pm to 1:20 pm. Students were instructed to bring a copy of the lecture notes to class, and it is apparent from Figure 4 that many students printed off the lecture notes, or at least accessed the website, just prior to class.

Except for Saturdays, activity throughout the week was fairly consistent, ranging from a high of 20.5% of total hits on Mondays to a weekday low of 12.4% of total hits on Fridays. Activity on Sundays represented 10.7% of total hits, and 5.5% of total hits on Saturdays. Many students likely have part-time jobs on Saturdays since students reported that they worked on average 8.5 hours per week for pay. Even if students were not employed, it makes sense that they may need a psychological break from their studies on Saturday following a busy week of classes. In general, the consistency from day to day

of the overall web server activity level is more evident than any marked variation in day or time (see Figure 5).

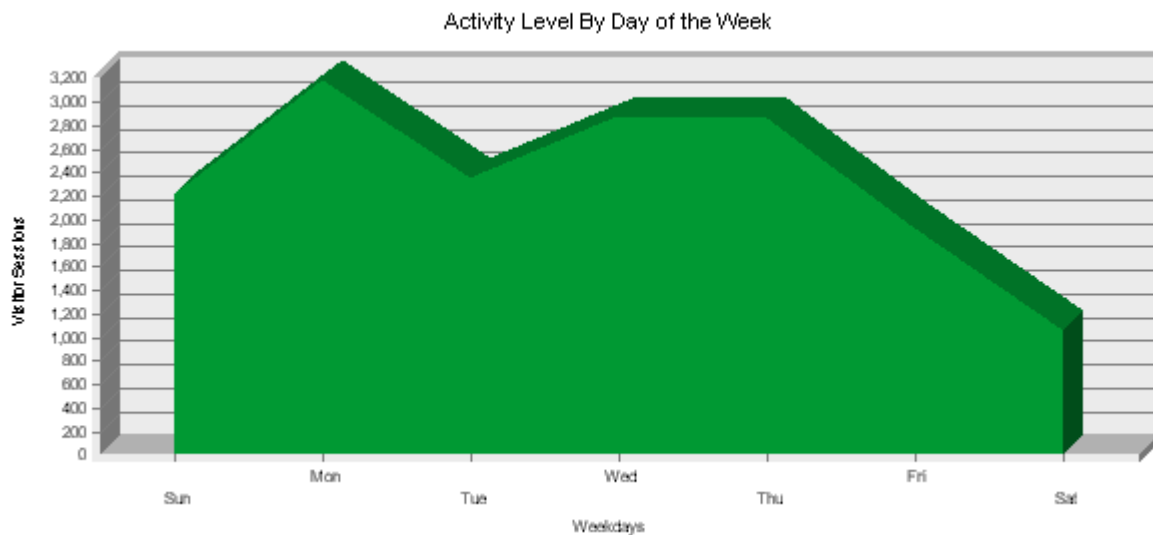


Figure 5. WebCT server hits graphed by day of the week.

Student navigation patterns.

The top entry page for the ECON 1010 website was My Lectures (mylectures.html). Just over 67% of visitor sessions began with this page. This makes sense because most of the multi-media and text-based resources for the course were located from within the My Lectures menu item. About 10.5% of visitor sessions entered the Tests and Exams directories first, and the remaining visitor sessions were fairly evenly divided among the other course menu items on the home page.

Of the twenty least requested pages, over half were related to study groups. The remaining pages were mostly about the last lecture delivered on May 4th. It could be that students did not take as much interest in the content of the last lecture or attendance was much higher than usual because it was the last class (Avi – any thoughts?). If students attended a lecture, they may be less likely to access the lecture slides and audio on the course website because they already heard the lecture in person.

Filtering the log reports to include and then exclude IP addresses within the block of IP addresses owned by York University’s on-campus networks (that is, 130.63.0.0 to

130.63.255.255) showed whether students accessed the website from on or off-campus. Table 5 lists the number of authenticated users who logged in from on-campus, from off-campus or from both locations.

Table 5
Access from on or off-campus

Student access point	Number of authenticated student visits
Login on-campus only	25
Login off-campus only	176
Login both on and off-campus	252

A total of 453 students logged in to the course website, but only 404 of these students received a final grade. This leaves a total of 49 students who did not receive a final grade, and presumably dropped the course. Only 25 or about 5.5 percent of the students who logged in never accessed the course website from off-campus. This percentage was even lower than that reported during a pilot study done in the fall of 2000. During the fall semester just over 10 percent of the students had access from on-campus computers only. It seems unlikely that students would chose to login from on-campus locations only if they had the option to access the course website from a computer off-campus. With such a small percentage of students logging in from on-campus only, it seems reasonable to speculate that computers are becoming ubiquitous among students.

Student conduct in general.

Students spent an average of 8 minutes and 50 seconds for each visit to the course website. However, 60% of all visits were less than one minute in length. This may indicate that students logged in frequently to check for new announcements, but quickly logged off if nothing new was found. Approximately 10% of all visits were greater than 19 minutes in length. So for 10% of the visitor sessions, students took a substantial amount of time to study the resources available.

There was a total of 17,440 visitor sessions in the ECON 1010 directories on the WebCT server during the semester. This represents a great deal of activity, which was for the most part generated by students (only six authenticated logins to the ECON 1010 website were not students). There were three file types students could download of the five resources available from the My Lectures menu: (1) Portable Document Format (PDF) files, (2) RealAudio (RA) files, and (3) PowerPoint (PPT) files. Students downloaded an astonishing 90,597 PDF files or 2,961 megabytes worth, 4,908 RA files, and 3,840 PPT files (1,112 megabytes). RealAudio files were streamed from another server, and according to the RA server log files, 2,463 megabytes of RA files were downloaded.

Student conduct related to class lectures.

The resources available in My Lectures (mylectures.html) was a major reason students accessed the course website. As previously noted, over 67% of all visitor sessions for the ECON 1010 course began with mylectures.html. For this reason, further analysis of the resources students accessed from this page was done. Table 6 shows the number of files, for each of the five types of resources available, downloaded for each of the 25 lectures during the semester.

Table 6

Number of files downloaded

Date of lecture	PPT files	PDF lecture notes	PDF whiteboard files	RealAudio files	Watch & Listen
February 26	319	891	None*	151	None
February 28	412	1,718	447	179	156
March 2	369	1,679	390	185	89
March 7	214	1,568	286	101	100
March 9	166	1,494	274	108	92
March 12	153	1,430	202	99	97
March 14	163	1,497	214	90	96
March 16	162	1,411	308	83	171
March 19	118	1,414	205	67	98
March 21	137	1,447	160	76	105
March 23	205	1,501	236	102	102
March 26	142	1,489	220	92	196
March 28	137	1,353	142	91	187

Date of lecture	PPT files	PDF lecture notes	PDF whiteboard files	RealAudio files	Watch & Listen
April 2	143	1,332	203	127	110
April 4	111	1,268	142	65	138
April 6	110	1,326	232	105	104
April 9	122	1,311	229	91	94
Test 1 Review	None	None	355	62	None
April 11	109	1,381	217	67	114
April 16	149	1,418	200	85	124
April 18	115	1,387	234	64	122
April 20	134	1,375	306	98	75
April 23	None	None	240	71	82
April 25	109	1,164	196	50	72
April 30	63	1,029	139	23	52
May 2	60	849	175	41	56
May 4	67	836	132	40	33
May 7	None	None	250	63	41
Test 2 Review	None	None	150	24	None
Exam Review	None	None	0	0	None
Mean	159.56	1,342.72	223.59	83.33	104.08
STD DEV	87.41	230.78	86.59	41.36	40.78

*None indicates that no files of that type were available to download for that lecture.

Students downloaded a lot of files. There was an average of 1,343 lecture note files downloaded each week, which means each student downloaded approximately 3 copies of this file for every lecture. Some of this activity can be explained by the fact that when students clicked on the Print link in My Lectures, the file loaded in Acrobat Reader. Then they had to click print a second time on their browser menu bar to actually print the file. This second click counts as another download because the file is re-loaded by the browser for printing. Still, this does not fully explain why, on average, students accessed these files three times for each lecture.

The lectures for ECON 1010 were held Monday, Wednesday and Friday from 12:30 pm to 1:20 pm. In order to understand student behaviour around lectures dates and times, a detailed activity summary was produced for a five-week period during mid-semester. Due to time constraints, activity reports for specific files were produced only for this five-week period. However, observing students' use of resources during mid-semester was thought to be most typical of their activity patterns. At the beginning of the term students are still learning to use the system, and at the end of the term students are focused on the final exam and activity patterns may change. Also, a number of students

may have given up trying to pass the course and thus decreased their activity on the website in the final weeks. Table 7 shows activity by day and by hour for each of the five file types available for each lecture from week 10 to week 15.

Table 7

Activity summary by day and by hour for each file type

Date of lecture	PowerPoint slides		PDF lecture notes		Whiteboard files		RealAudio files		Watch & Listen files	
	Most active day	Most active hour	Most active day	Most active hour	Most active day	Most active hour	Most active day	Most active hour	Most active day	Most active hour
March 21	March 21	12 to 1 pm	March 21	10 to 11 am	March 22	11 to 12 noon	March 22	10 to 11 pm	March 29	9 to 10 pm
March 23	March 23	11 to 12 noon	March 23	11 to 12 noon	March 25	10 to 11 pm	March 25	9 to 10 pm	March 29	1 to 2 pm
March 26	March 25	6 to 7 pm	March 26	10 to 11 am	March 28	11 to 12 noon	March 28	11 to midnight	April 24	10 to 11 pm
March 28	March 28	11 to 12 noon	March 28	11 to 12 noon	April 3	11 to midnight	April 2	11 to midnight	April 24	midnight to 1 am
April 2	April 2	1 to 2 pm	April 2	11 to 12 noon	April 3	5 to 6 pm	April 3	10 to 11 pm	April 24	6 to 7 pm
April 4	April 4	12 to 1 pm	April 4	11 to 12 noon	April 8	2 to 3 pm	April 25	3 to 4 pm	April 23	11 to midnight

As can be seen in Table 7 and Figure 4, students were literally printing the lecture notes, and for the most part the PowerPoint slides as well, minutes before the lecture began. The whiteboard and RealAudio files were accessed a day or more after the lecture, and the Watch & Listen files were often accessed many weeks later. In fact, most of the activity related to the Watch & Listen files came right before the first and second test, which were given on March 30th and April 27th respectively.

Student conduct related to old tests.

Another key resource for students on the ECON 1010 course website was the availability of old tests and answers to the old test questions. Most students, that is, 386 of 444, or 87%, accessed the old tests directories. Students downloaded 33,009 PDF files containing old test questions, which represents about a third of all PDF files downloaded. However, students downloaded only 13,073 PDF files containing the answers to the old

test questions. One possible explanation of why students did not download the answers nearly as often as the test questions is that they didn't actually print the answers – they viewed the answers on screen after completing the test. As previously noted, clicking print on the browsers menu bar results in another download of the file. However, this interpretation still does not fully explain the gap in downloads between questions and answers.

Class interactions in WebCT.

WebCT's own internal tracking tool counted the number of items in the discussion board that each student read and posted, and this provided data on student activity within the discussion board on WebCT. Students read an average of 64 items of the 216 total items in the discussion board (see Figure 3). Professor Cohen posted 37 items in the Announcements area, so it seems reasonable to conclude that most students read Avi's messages. However, since students read an average of only 64 messages, the majority of students were not reading all of the 179 items in the Main discussion area where students could post messages themselves. Only 14 students read all 216 items, and only 47 students read more than 150 items. However, 245 students did read more than just the 37 items posted by Dr. Cohen, which indicates students found their way to the Main discussion area, but for some reason did not read everything their classmates contributed. The average number of messages posted per student was less than one or 0.37, and the highest number of messages posted by any one student was 13.

Students who joined a study group were also given their own study group area within WebCT. Participation in a study group and in the virtual study group was voluntary. Each study group area had its own discussion board, a chat button for real-time synchronous discussions and a whiteboard feature; students would enter this area by clicking on the name of their study group from their WebCT home page. About 29% or 129 of the 444 students signed up for a study group; there were 17 groups in total. Students gave their groups a creative name, such as, "The Greenspans" and "Da Gangstas." Table 8 provides a summary of the activity level within each virtual study group for the 17 groups.

Table 8

Messaging activity level for the study groups

Number of messages posted in the study group's discussion board	Number of groups with this messaging activity level
zero messages	6 groups
1 message	4 groups
2 messages	3 groups
3 messages	1 group
4 messages	2 groups
9 messages	1 group

There were a total of 30 messages in the discussion boards for the 17 study groups. The content of the messages was about study group mechanics, such as meeting times, and did not relate to macroeconomic matters. From these observations it was obvious that students made little use of the virtual study groups.

Student activity within the whole class ECON 1010 discussion board was somewhat higher than the study groups, although most (351) students did not contribute (post) any messages at all. Also, as previously noted only a small portion, roughly three percent of students, read all of the messages in the ECON 1010 WebCT discussion board. The low level of interaction online between students is in sharp contrast with the high amount of activity recorded accessing online resources such as the PDF files, PPT files and RealAudio files. One explanation for the low activity level is that participation in the discussion board was voluntary.

Student achievement and web server activity.

Using the SPSS statistical analysis software package, descriptive statistics and a Pearson Correlation were generated comparing the number of Hits, and visitor Sessions with each student's Overall Course Mark. Of the 444 students who received a final grade for the class, 40 or approximately 10 percent did not login to the ECON 1010 website. These 40 students were excluded from the correlation because they had no login data for comparison.

Table 9
Descriptive statistics

	Mean	Std. Deviation	N
Hits	582.30	340.04	404
Sessions	35.39	21.33	404
Overall Course Mark % Raw Score	58.640	15.811	404

The mean number of sessions was just over 35 per student, and with just 12 weeks in the semester this indicates students logged into the ECON 1010 website nearly 3 times per week on average. This finding supports the conclusion that most students were quite active in using the course website.

Table 10
Correlations

		Hits	Sessions	Overall Course Mark
Hits	Pearson Correlation	1.000	.777**	.268**
	N	404	404	404
Sessions	Pearson Correlation	.777**	1.000	.365**
	N	404	404	404
Overall Course Mark	Pearson Correlation	.268**	.365**	1.000
	N	404	404	404

**Correlation is significant at the 0.01 level (2-tailed).

The correlation between the number of Sessions (.365) and Hits (.268) and Overall Course Mark was not strong but positive and significant at the 0.01 level. Although the correlation between the number of Hits and Sessions was stronger at 0.77, it only indicates that students who had more visitor Sessions also had more Hits, and this was predictable. The fact that the correlation between Hits and Sessions was not even stronger (closer to one) shows variation in students' approach to their web sessions. Some students login more often, and log more visitor Sessions, but spend less time for each session, therefore generating fewer Hits, and vice versa.

According to data supplied by Professor Cohen, the average Overall Course Mark was 58% for all 444 students. However, the average Course Mark for the 404 students who accessed the ECON 1010 website was slightly higher at 59%. The average Course

Mark for the 40 students who did not login was much lower at 48%. Although the higher scores and significant correlations for students who used the website is a positive result, it would be inaccurate to attribute higher scores to the existence of the course website. We cannot know whether the website helped students get higher marks or whether the better students were simply more likely to use the website more extensively.

(Avi – do you have any reliability measures for your tests and exams?)

Qualitative Analysis of Textual Data

Using qualitative data analysis software, Atlas.ti, text materials from the focus group transcription, the two open-ended items in the Flashlight survey, and the WebCT discussion thread were coded and analyzed. The theoretical framework used to develop the codes was derived from the seven principles of effective practice (see page 8). Table 11 is a summary of the codes used, and includes the frequency for each code for each of the four primary text documents.

Table 11

Primary Document Code summary

Codes	WebCT discussion thread	Survey -- open-ended question 32*	Survey -- open-ended question 33**	Focus group transcript	Totals
1 accessibility issue	5	2	0	1	8
2 any pace	7	10	0	3	20
3 anytime anyplace	11	40	2	2	55
4 application to real world	0	0	4	0	4
5 clear organization/presentation of information	0	6	6	3	15
6 cognitive and creative outcomes	10	21	2	12	45
7 collaborative learning	8	9	4	4	25
8 engagement in learning	5	4	1	2	12
9 faculty-student interaction	3	7	2	1	13
10 face-to-face (FTF) comparison	3	0	0	2	5
11 not using study groups	10	7	14	6	37
12 old tests	7	7	0	3	17

Codes	WebCT discussion thread	Survey -- open-ended question 32*	Survey -- open-ended question 33**	Focus group transcript	Totals	
13	other course comparison	15	24	8	4	51
14	PDF files	7	5	0	2	14
15	positive addiction to technology	23	13	0	0	36
16	PowerPoint files	3	1	0	5	9
17	RealAudio files	9	3	1	7	20
18	respect for diversity	7	18	5	2	32
19	rich and rapid feedback	8	1	4	0	13
20	synchronous chats	9	4	9	2	22
21	technical skill deficiencies	7	9	4	2	22
22	technology negative	1	2	0	4	7
23	technology preference	3	0	0	4	7
24	time on task	3	9	2	4	18
25	using the technology	5	5	23	10	43
26	using time productively	7	5	3	8	23
27	value of technology/resources	15	50	3	9	77
28	watch and listen feature	12	6	3	5	26
29	WebCT discussion boards	5	9	4	5	23
30	whiteboard files	4	1	0	4	9
	Totals	212	278	105	116	711

*Question 32: What else would you like us to know about your experience with the technologies used in this course?

**Question 33: Can you give us any advice on how to improve this course?

Using the seven principles of effective practice to frame the discussion of the qualitative analysis, we will begin with faculty-student contact and giving prompt feedback. Codes 9 and 19 dealt with students' impression of faculty contact. Although there was not a great deal of comment about this, there was no real dissatisfaction expressed either. Students seemed to recognize that the size of the class made faculty-student interaction difficult, and appreciated Avi's efforts to increase contact via WebCT. One student wrote, "WebCT discussion board was very useful as well. The professor was quite fast in responding to any questions that one might have, which might benefit not only the student asking the question but many more." Students really appreciated Dr. Cohen's prompt responses in WebCT: "The professor also responds very quickly and that's great too!"

Encouraging cooperation among students was one area where students had a number of suggestions. Many quotations within codes 7, 11, and 20 talked about how students valued student-student interaction: "I like how the students are able to interact

with one another on the discussion forums.” But many students also chose not to get involved in a study group. Here is one student’s comment: “Not everyone is in a study group for reasons like myself being that it is not always the best thing for a student, and sometimes they just don't work out.” Students who did not sign up for a study group took exception to not being able to use the online chat feature: “the reason as to why I feel that a course wide chat would be of more help is because it allows students to interact with one another in a quicker fashion and the major idea being that it is open to the entire class and not just to study groups.” Another student confirmed what many of his peers also expressed:

One thing that I am dissappointed with is the fact that because I am not signed up to a study group in a formal manner I do not have access to the virtual study group. Therefore bringing me to my suggestion which is to allow access to an economic chatroom that involves the entire class that way if someone in the virtual study groups cannot solve a particular problem they can go on an “all access chat” and maybe someone there can answer.

Finally, students had a number of interesting suggestions for increasing student-student interaction. For example, here is one student’s idea:

. . . and I noticed that they were having an online debate. I don't know how or if this would work in our class, but it is one idea to get people involved in the discussion function on WebCT. You could start the discussion by stating something controversial. For example "Free Trade is bad..." (not that this is my opinion, but I couldn't think of a better example).

Codes 4, 6, and 8 captured students’ comments that dealt with encouraging active learning and communicating high expectations. One student wrote, “I really appreciate the way this course [is] designed and that is the only reason I continued in this course although I didn’t get good marks but in anycase this course helped me or I would say created a deep interest in economics.” A few students made comments about having

more opportunities for “applying the issues we learn more to the real world.” Also, several commented on revising assessments to include marked assignments. One student wrote about both of these practices:

I think assignments will be a good idea. I think they make the student think about the material, and can also be lots of fun, and can help them learn better. Doing questions from the study guide is good, but most because we are not being marked on them, it's less motivating to do them. I also think this course should have some more involvement with current economics issues, some assignments on this will be a good idea because it will help the students apply what they have learned.

Above all, students found the technology used in the course extremely valuable for their learning. There were numerous quotations about how the PDF lectures helped students concentrate during the actual lecture. “It helped me focus more on the subject matter (as opposed to being constantly distracted by the need to take down everything the professor says).” Another student put it this way:

I find it extremely helpful to be able to print out the notes for lectures ahead of time. It makes the learning experience during the lecture more intense because I am able to fully concentrate on the material covered. Instead of frantically trying to make adequate notes I often find myself relaxed and fully engaged into the material.

Students also thought the technology gave them the ability to actively study difficult material and proceed at their own pace: “if I don't get it the concept when I listen to it the first time, I just listen to it again, bit by bit until I fully understand the whole topic.” Finally, nearly forty students wrote that they were better able to handle the course content because of the technology: “if I didn't have the technology the whole class would be over my head.”

Time on task includes time management skills as well as using time productively. Codes 2, 3, 24, and 26 covered these areas. Students definitely felt that the technology used in ECON 1010 saved them time: “I find this [course technology] particularly useful when I miss classes, saving me the time and effort of trying to find someone who could explain to me the prof's notes.” Not only did the technology save time and even money

in some cases, it also helped students organize their time. “This is an excellent way of aiding students in their understanding of course material as well as personal time management.” Another student commented, “the infusion of technology in the course helped me organize my time for studying by clearly setting out what I needed to know.” A number of students indicated that they did not attend lectures in person because they could get everything they needed online: “I really liked having the lectures accessible online and I never attended any classes because of this feature.” However, having the freedom to miss lectures was seen as a problem for some students: “it allows for WAY TOO MUCH procrastination!!”

Respect for diversity means students with different preferred learning styles and abilities have choice in learning methods and course assessments. Once again, the technology empowered students in this regard: “I have many different ways in which to access the material so my learning is enhanced.” Another student wrote, “the technology has made the material extremely comprehensive. It has given everyone the opportunity to do well and backtrack through material.” Students whose first language was not English especially appreciated the opportunities the technology afforded them:

I am international student, so it is difficult to understand all what you say in class, not only detail of ECON but also administrative announcement etc. So this web site and technology are very usefull and helpfull for me to follow this cause [course]! I like this.

As previously noted, a number of students recommended including different types of assessments other than tests and exams: “I feel that the course should not be weighted entirely on three tests. Students should be given an assignment worth 25-30% as well.” Another student believed that his mark on the tests did not reflect what he had learned: “for some reason I feel, the marks I earn on tests and exams is not a good indicator of my skills or concepts in this course.” Similarly, this student also tried to express his belief that tests and exams only represented one type of assessment:

I mean it's not a course where you have any assignments, it's all test based; I think in some ways assignments would have been good, because I think it would have given you an opportunity to, let's say, if you're on a bad track to balance it out.

Thus, students would appreciate more diversity in assessment methods; however, with so many students enrolled this may not be a reasonable option.

Besides addressing areas related to effective practices, students also made numerous comments about the different types of technologies available to them on the ECON 1010 website. There was very strong support for the PDF lecture notes and the RealAudio files, as previously noted. One student summed up his use of the RealAudio files this way: "I regularly use the Real Audio files. . . . I can easily refer back to challenging parts of a lecture and "pause" the professor to make more elaborate notes." However, many students reported that they "really didn't use the whiteboard that much." This is not surprising because students who attended the lecture had an opportunity to make their own drawings or notes similar to Professor Cohen's sketches. Although there were not as many specific comments about the PowerPoint slides, some students mentioned that the slides were "extremely useful to watch as discussion progresses through shifts of different curves and the diagrams change to demonstrate a new learned concept."

For the Watch & Listen feature, many students remarked that the time lag made it less useful: "I rarely use the watch and listen function because there is such a time delay and the listen function [RealAudio] allows me to get a hold of the lecture before I attend the next one." Technical problems with the Watch & Listen feature were also noted: "the real audio "listen and watch" function doesn't have satisfactory results for ppl [people] using low bandwidth internet connections at home." However, a few students were very enthusiastic about the Watch & Listen feature: "the watch and listen function is truly a beautiful thing!" It is interesting to note that despite the negative comments about the Watch & Listen feature, the log files show that students downloaded an average of ~104 Watch & Listen files compared to an average of ~83 RealAudio files. So the Watch & Listen feature was more widely used than the textual data would indicate, and it might be even more popular if the delay in posting Watch & Listen files is decreased.

Although students were not asked for their perceptions beyond ECON 1010, they frequently made comparisons between their other courses and the technology used in ECON 1010. "I feel that all the technology used in this course is truly a great resource for us students, it is unfortunate that none of my other courses have these features."

There was a strong call from students to increase the use of technology in all courses at York: “I think there should be a rule for all professors to use the webct-feature, like you [Dr. Cohen] are.” There was also tremendous enthusiasm for the ECON 1010 course because of the technology: “It was the greatest course that I took this year. The technology is immensely helpful.” The fact that there were 51 unsolicited comments specifically comparing the technology in ECON 1010 with other courses is strong support from students for continuing this practice.

Conclusions

On the whole students were thrilled with the technologies used in the ECON 1010 course, and wished all of their courses had these features. They loved the freedom and the increased access to course content that the technology enabled. Generally, students did not lack access to technology or computers nor did they view learning the WebCT user-interface an obstacle to their learning. Based on the findings in this report, there are no significant technological reasons for faculty to hold back implementing web-based resources. The only noteworthy technological issue for ECON 1010 was to improve the speed with which the Watch & Listen files were posted on the course website.

In terms of the seven principles of effective practice, the design and delivery of ECON 1010 was exemplary. Throughout this report, students revealed that the technology encouraged student-faculty interaction, emphasized time on task and respected diverse talents and ways of learning. Furthermore, Professor Cohen’s understanding and beliefs about effective practice influenced him to competently use the technology to give prompt feedback, communicate high expectations and encourage active learning. Students valued interaction with their peers, and encouraging cooperation among students is one effective practice where students thought the technology might be used differently to promote student-student interaction. The server log files support the finding that interaction was limited. However, a large enrolment course such as ECON 1010 presents unique challenges in accomplishing the goal of increasing student-student interaction.

The extraordinary amount of student activity recorded in the WebCT server log files is by itself strong support for continued use of technology-enhanced courses. The log files showed that most students made significant use of the website, and the few students who did not access the website were among the poorest achievers. The resources available to students on the course website were accessed anytime and from anyplace. Perhaps even more significantly than anytime and anyplace access to resources, the technology also gave students the ability to review the lectures at any pace. However, creating and maintaining these resources is time-consuming, and not all faculty will have the time or the ability to make such resources available to their students. Yet this report has shown that students perceive technology enhanced course websites very positively. The technology used in ECON 1010 respects diversity by giving students more options. With more choice, students have more control over their own learning, and this is a first step to helping students become life long learners.

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