

WWW Lecture Material Delivery :

A 'Cost Benefit' Analysis

Elsie Tsang and Con Nikakis

Information Departments, Victoria University of Technology

ABSTRACT

Business Data Communications is a third year undergraduate subject in the Information Systems Department of Victoria University of Technology. About sixty students enrolled in this subject in Semester 2, 1996. In past semesters, lecture notes were delivered to students through a Local Area Network (LAN) server of the university. Students might choose to print the notes directly from the server in the computer rooms or they could download these files and print them at home. With the use of Internet technology becoming very popular in recent time and with easy student access within the university, as well as some access from outside the university there is the opportunity to use the Internet as a delivery tool for lecture materials. This paper aims to explore the 'cost benefit' of delivering these lecture materials on a WWW server in HTML format as compared to the current delivery methods for this subject. The objective of this paper is to compare two delivery methods, LAN server vs. WEB server, in relation to the extent of extra work load required to develop the WEB server materials.

INTRODUCTION

Since 1993, there has been incredible development in advanced computer networking and the popularization of the World-Wide Web (WWW) in business and research (Cain 1995). However, what impact has such technological innovation had on education and what exactly can the WWW offer education? Very little has been done by educationists to fully evaluate the WWW as a teaching tool. The objective of this case study is to compare two course materials delivery methods, LAN server (course materials available for download) vs. WEB server (course materials available on a WEB server in HTML format for viewing and printing), in relation to the extent of extra work load for staff required to make available the course materials in HTML format.

BCO3146, Business Data Communications, is a third year undergraduate subject taught within a Bachelor of Business course at the Victoria University of Technology. About sixty students took this subject in semester 2, 1996 and attended lectures and workshops at three different campuses. Students of this subject were chosen for this case study for three reasons. First, all of them have had computer experience, unlike first year students — some of them may not even have had access to a computer in the past; which makes the tasks of downloading, copying and printing simpler. Second, the topic 'Internet' was covered extensively in their subject syllabi, preparing them for an understanding of the communication protocols, structures and services that underlie their activities. Third, the investigators have easy access to these groups.

METHODOLOGY

Observations and survey questionnaires with students were identified as tools for conducting this case study. Observation took place during workshop hours. Students were observed whether they had difficulties in using the Internet. Alreck and Settle (1985) reported that questionnaires was to focus directly on understanding and predicting students' behaviour when using the Internet.

- A web counter was set on the web page so that the number of people accessing the web page could be recorded.
- In weeks 11 and 12, questionnaires were sent to students at all three different campuses — Footscray, St. Albans and Melton. At the Footscray campus, 18 students out of 20 completed and returned the questionnaires. At the St. Albans campus, 20 students out of 35 did so, while at the Melton campus, 7 out of 15 students responded. The analysis of the questionnaires is listed in a later section of this paper.

EXTRA WORK LOAD FOR THE STAFF

For this subject, we need to deliver to students the following course materials: 1 course guide, 2 sets of assignment questions, 12 sets of lecture notes, 9 sets of workshop handouts and a set of past examination papers. Each set of lecture notes covered the content of a two hour lecture. Each set of workshop handouts contained the practical exercises and research questions for a two hours' workshop. All these materials were pre-prepared in Microsoft Word 6.0 (WORD) document and Pagemaker Version 5 format.

After discussion, we decided that initially only the course guide and the lecture notes would be placed on the web pages but not the others. This was due to two reasons. First was the time constraint for constructing web pages and second, students would need a guaranteed hard copy to do the practical exercises during workshop hours. We decided to continue the current practice of providing the workshop handout in hard copy format to students one week before the workshop.

There were altogether 92 pages and 64 figures in the course guide and the 12 sets of lecture notes. The first job in this case study was to convert these WORD document files to HTML files and each figure from picture on WORD to a GIF file. As a new inexperienced HTML author, it took **45 working hours** to construct the web pages. In addition to these forty-five hours, time was spent (two to three hours) on downloading software development tools from the internet and then installing them on the computer.

The first ten hours were spent on designing the format, establishing the links between web pages and formatting. Another twenty five hours were spent on the conversion of WORD document files to HTML files. The Web Page Construction Kit software package was used which could convert most contents in the WORD files except the tables and lists in WORD document files. In view of this constraint, it took an additional time to include these items in the web pages. Another eight hours was spent in converting 64 figures into 64 GIF files because each figure had to be converted one at a time by using the Paint Shop Pro software. Finally, it took two hours to place files on to a UNIX WEB server and modify the files and directories for WEB delivery. Since this was the author's first experience in constructing web pages, it took a surprising forty five hours to complete the task. If repeated the author is confident that the time taken can be reduced by one third. The learning curve therefore contributing to 15 hours from the 45 hours in total.

OBSERVATIONS

Students were observed during the workshops. They seldom accessed lecture note web pages but most of them could handle the use of the Internet browsers effectively, especially during the last three workshops, where students were required to search for information from the Internet for their network design assignments. We are therefore quite sure that they had no difficulties in using the Internet browsers.

The numbers of users were also recorded each week in order to observe how frequently the web pages were accessed. The following were the results taken from the web counter :

Week No.	No. of visitors
5	9*
6	20
7	21
8	21
9	21
10	24
11	25
12	27
13	31

Note: * the testing was done by us before we informed students.

It was observed that about 14 (17 out of 31 were my login) visitors had actually visited the site. This number was very small in comparison with about 60 students expected to access the web site. This was not an encouraging figure to us in response to the number of hours that had been spent on constructing web pages.

ANALYSIS OF QUESTIONNAIRES

The questionnaire consisted of ten questions. A copy of the questionnaire is attached in Appendix 1. There were about 60 students taking the subject and 45 questionnaires were returned. Students filled in the questionnaires either during the lecture or workshop hours. They took about 15 minutes to complete the questionnaire. The following is the feedback for each question:

Question 1

Do you know how to gain access to the Internet before you attended BCO3146 ?

Result: 38 students replied 'yes'

7 students replied 'no.'

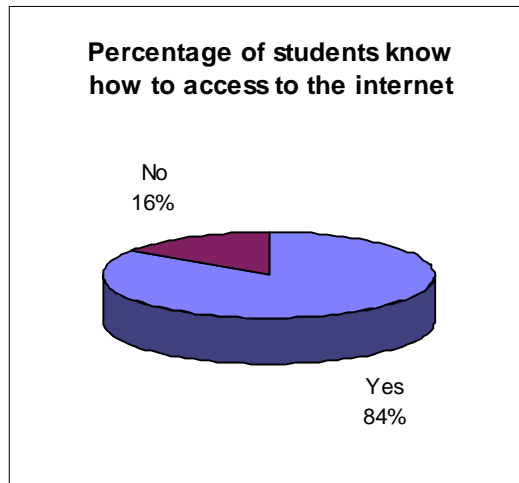


Figure 1: Percentage of students knowing how to gain access the Internet before BCO3146. These figures appear to indicate that most students had experiences in accessing the Internet.

It appears that no special training on using the Internet is required.

Question 2

Can you access the Internet besides using facilities at the university ?

Result: 35 students replied ‘no’
10 students replied ‘yes’.

For these ten students replying positively, five students used a remote dial-in connection from home to the university, whilst two students used facilities at work. The remaining three students, used an internet cafe, a local library, and a friend’s PC.

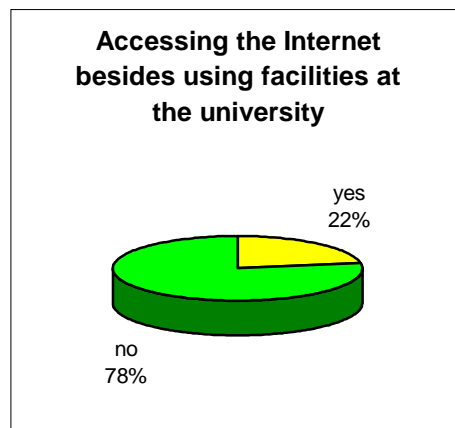


Figure 2: Percentage of students could access the Internet while not in the university. These figures indicate that not many students could access the Internet using facilities other than the university’s. In other words, thirty five students, about 80%, needed to be enrolled at the university in order to access computer facilities and the Internet.

It appears that it will not make much difference to our students whether we use ‘files on the server’ or ‘web pages’ at this moment since they need to be physically present at the university any way.

Question 3

Which method do you use to get copies of your lecture notes ?

Using the above method, how many hours have you spent in obtaining 12 sets of lecture notes?

The results were analyzed and listed in the following table:

Table 1: Number of students in using different methods for obtaining lecture notes

Methods	Number of students					Total
	< 1 h	1-2 h	2-3 h	3-4 h	> 4 h	
using the Internet to access web pages <u>in the university</u>	1	2	1	1	1	6
using the Internet to access web pages <u>at home</u>	1	0	1	0	0	2
directly print the lecture notes <u>in the university</u> computer room.	6	7	3	2	1	19
download the files from the server to the disk, then print them <u>at home</u> .	7	5	0	0	0	12
download the files AND access web pages, then print them <u>in the university</u> .	1	1	1	0	0	3
download the files AND access web pages, then print them <u>at home</u> .	0	1	0	0	0	1
borrow hard copies from your friends and then make photocopies.	0	1	0	0	0	1
I never get copies of lecture notes	0	0	0	0	0	0

From our analysis of these figures, it was noticed that the hard copy of lecture notes was essential from students' point of view, since no one had chosen the option 'I never get copies of lecture notes'. There were thirty one students using the traditional method i.e. files on a LAN server. Amongst these 31 students, 13 of them took less than one hour to get hard copy of notes, eight students were using the Internet either in or outside the university and four students were using both methods.

As we want to compare the time spent on printing using WEB server or LAN server, the above data were grouped into two categories, disregarding whether students accessed them in the university or outside the university. The following figure shows the numbers of students who spent a specific number of hours on each of these two methods.

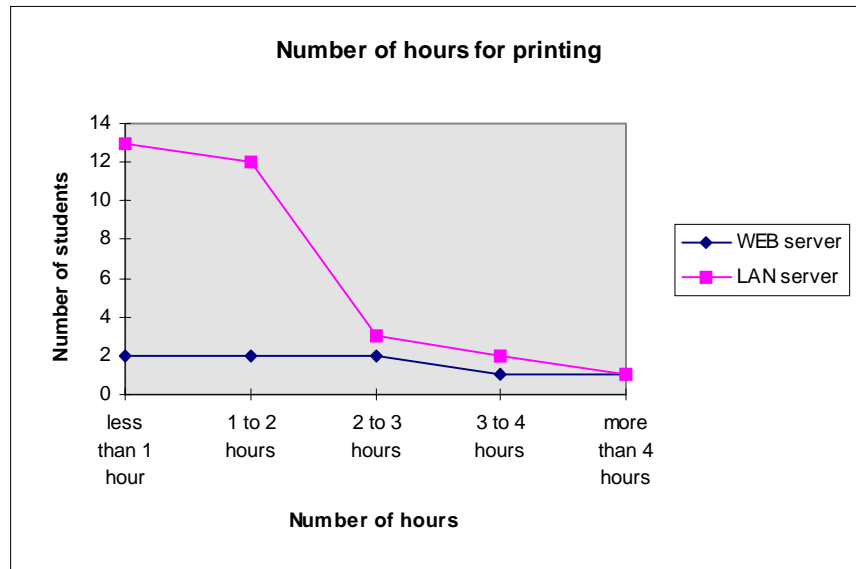


Figure 3: Numbers of students spent a specific number of hours on each of these two methods.

In order to make inferences about a population, we need to define the numerical descriptive measures of a set of data. Here we confine our attention to two types of descriptive numbers : measures of central tendency, mean, and measures of dispersion, standard deviation (Menedenahall et al. 1981).

Table 2: Mean and Standard deviation of printing time of using WEB and LAN server

Class mark x (in hours)	0.5	1.5	2.5	3.5	4.5	Total	mean	standard deviation
WEB server	2	2	2	1	1	8	2.12	1.41
LAN server	13	12	3	2	1	31	1.40	1.04

The mean printing hours for using WEB server is 2.12 hours with the standard deviation of 1.41 hours; whereas the mean printing hours for using LAN server is 1.40 hours with the standard deviation 1.04 hours. It was thus observed that the printing hours for using LAN server is shorter than WEB server and it deviates less from the mean. About 21 students, representing 68%, who used LAN server for printing were within the interval from 0.36 hours to 2.44 hours.

These results suggest that the traditional method — “files on server” would remain the most popular in the near future from the students’ point of view. It should also be relatively efficient, as most students had taken less than one and half hours to print the lecture notes.

Question 4

Do you read the content of the lecture notes briefly at least once on the Internet screen, before you print the lecture notes ?

Result: 2 students chose ‘ yes, I read it thoroughly’.
 23 students chose ‘yes, I glance through it’.
 20 students chose ‘no, I just print it directly from the Internet’.

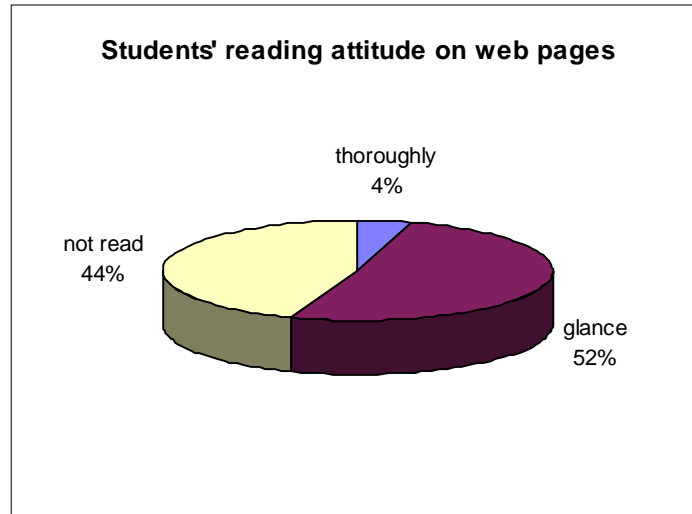


Figure 4: Students’ attitudes on reading WEB pages

This result threw some light on the students’ reading attitude. Since 44% of students do not read the lecture notes and just print them directly from the Internet, 52% of students just glance through it, it is doubtful whether we should construct the web pages at all.

Nearly half of the students just print the web pages without reading the Internet. From students’ point of view, there will be no big difference whether the lecture notes were from the WEB page or from the files on the LAN server.

Question 5

Which way do you prefer to study your lecture notes for examination purpose?

Result:
 44 chose ‘I read from the hard copy and underline the important points and make notes on it’.
 1 chose ‘I read directly from the computer screen and never make hard copies for lecture notes’.

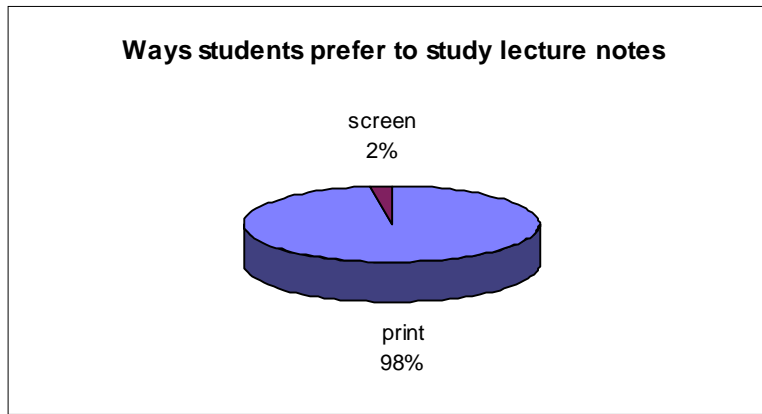


Figure 5: *Ways that students prefer to study the lecture notes for examination purpose.*

This appears that the traditional reading habit had not changed. In the old days, we did not have computers and so we studied through printed books or notes. Computers have now become popular, but students were still accustomed to reading from ‘paper’ instead of ‘screen’, especially for the purpose of examination.

Students’ reading habits did not change too much between now and the past — hard copy (prints) were still essential to them for study purposes.

Question 6

Do you think that lecture notes delivered on web page is a good idea ?

Result: 38 students chose ‘yes’.

7 students chose ‘no’.

The following reasons were given by those students who thought that lecture notes on web page were not a good idea on their questionnaires :

- hard copy are readily available and can easily be accessible;
- very confusing, especially the links, page break, images and text cannot be printed neatly;
- it takes time to download and the layout looks funny;
- much time spent on locating, downloading and printing;
- I do not use it; and
- cannot be accessible by students.

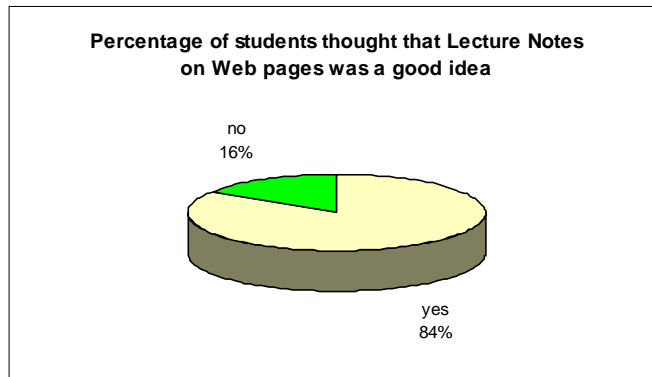


Figure 6: Percentage of students who thought that lecture notes on WEB pages was a good idea.

Surprisingly, most students thought that putting lecture notes on web pages was a good idea. Maybe it gave them an additional means to obtain the lecture notes in case they have gone astray or maybe they have been ‘effected’ by the Internet ‘hype’.

Question 7

Which of the following methods in delivering lecture notes do you consider the most suitable for you ?

Result:

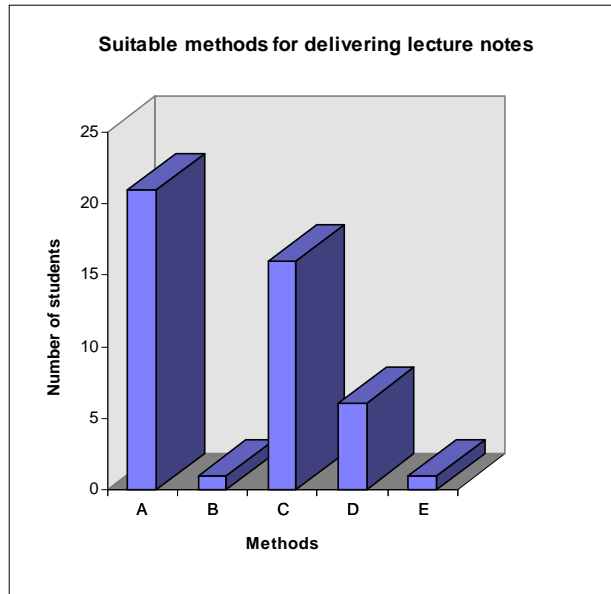
21 students chose ‘hard copies directly distributed to you from the lecturer.’

1 student chose ‘borrow hard copies from your tutor/classmates and then make photocopies by yourself.’

16 students chose ‘lecture notes on the file server and make copies by yourself.’

6 students chose ‘lecture notes on the web pages so that you can access on internet.’

1 student chose ‘notes in the university library reserve.’



Legend:

A: hard copies directly distributed to you from the lecturer.

B: borrow hard copies from your tutor/classmates and then make photocopies by yourself.

C: lecture notes on the file server and make copies by yourself.

D: lecture notes on the web pages so that you can access on the Internet.

E: notes in the university library reserve.

Figure 7: The most suitable delivering methods

These figures show most students prefer the lecturer to give them the hard copy while their second preference is to use the traditional method of putting the notes on the file server.

Students thought that lecture notes on web pages was a good idea but once they needed to print these notes by themselves, most of them prefer the other ways — perception is different to practice.

Question 8

If we are not going to supply you any lecture notes, but instead we print the whole set of lecture notes in the form of a text book and charge you at cost price, would you buy it ?

Result: 39 chose 'yes'.

6 chose 'no'.

Those who supplied negative answers gave the following reasons:

- They will take notes during the lecture.
- They will borrow from friends and then photocopy.

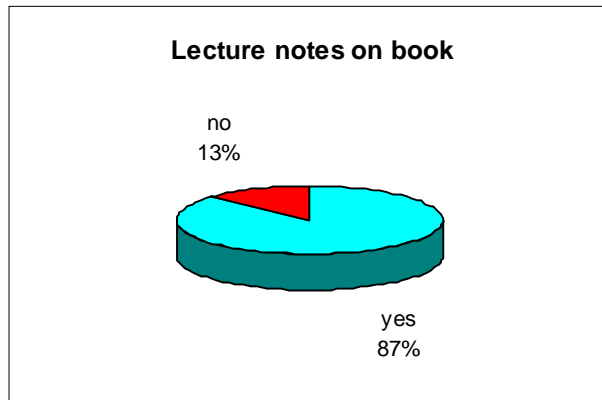


Figure 8: Percentage of students would buy the book for lecture notes

From the university's point of view, in order to utilize the limited internal resource, the most practical way will be to publish the lecture notes in the form of a book and sell it to students at a reasonable price.

Question 9

Have you encountered any difficulties in getting the lecture notes using the Internet?

Result: 4 chose 'yes'.

41 chose 'no'.

Students encountered the following problems :

- printer jam
- hard to print out a large amount of lecture notes at any one time
- take too long to print

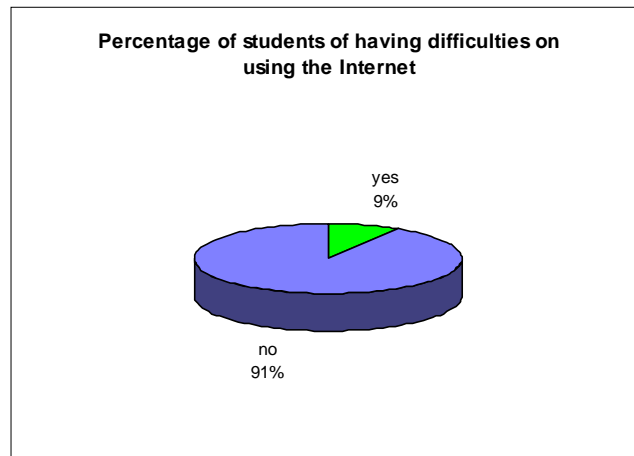


Figure 9: Percentage of students of having difficulties on using the Internet

Despite some relatively minor problems encountered by the students, most of them had no problems in getting copies which were downloaded from the Internet web pages.

Question 10

Any suggestions about the content or format of the web page?

The following suggestions were raised by students in their questionnaires :

- organise all materials on a pattern which could be easy to follow
- well designed and easy to use
- user friendly
- shorter, simpler URL if possible
- proper heading, nice fonts, not too many links

CONCLUSION

From this survey, it was understood that **ALL** students will still require a copy of lecture notes for exam study purposes.

Survey Results

There are many ways to deliver lectures notes to students. From the university point of view, transforming lectures notes into books and selling them to students at a reasonable price would be the most beneficial one. 87% of the students could afford it and were willing to pay. From the students' point of view, distributing lecture notes directly by the lecturer to them was the most economical in terms of money and time. For BCO3146, our previous practice was to put the lecture notes on a LAN server. Students were then able to print them at the university or at home. From the angle of the academic staff, this method saved their photocopying and distribution time. As the Internet technology becomes popular and more accessible, this case study aimed at evaluating whether putting the lectures notes on a WEB server instead is worthwhile. The evaluation was centred on the effectiveness of the possible changes in terms of time spent on constructing the WEB pages and students' enhanced learning achievement as compared with the traditional method of files on a LAN server. The results tend to show that a majority (84%) of the students considered putting the lecture notes on WEB server a good idea but only a minority of them (13%) were happy with the option of printing the lecture notes from the Internet. Most of them preferred the lecturers to be distributed to them as hard copy of lecture notes directly or they preferred the existing practice — files on a LAN server. It was also observed that only a very limited number (4%) of students read the Internet WEB pages thoroughly — most of them just print them. It may also show that WEB pages, in comparison to files on a LAN server, do not help students learning achievement too much — printing the WORD files or printing HTML files makes no difference to the students. It was found that almost all (98%) the students were only reading a hard copy instead of the screen for examination preparation reasons. In other words, there would not be much difference between putting files on LAN server or on WEB server — either way students will just read the hard copy. About 22% of students can access to the Internet from outside the university. Combining all these aspects, in addition to the several tens of hours to be spent on constructing the WEB pages for reading by less than 20 viewers, we can conclude that lecture notes on WEB pages **were not** worthwhile pursuing under these circumstances.

Cost Constraint

In addition to these factors, we have not considered the possibility of students giving less support to the new scheme once they need to bear the Internet fee themselves. If this scheme is to be implemented, students may very likely change their views. In September, 96 the Information Technology Department of VUT wrote to the staff advising that the monthly Internet charges at the VUT had been increasing tremendously. — from \$670 in April, 1996 to \$7790 in August, 1996. From these we can understand that the monthly Internet costs has been rising very rapidly to a level that restrictive actions have to be taken. Of course, one of the most effective ways to control the costs will be to implement a “user pay” system, i.e., passing on the costs to the users. Currently, the university's Internet charges are not being passed on to Faculties and Departments. Given that the adverse implications of the Federal Government's budget cuts, all VUT internet users have been “reminded” to make prudent and cost-effective use of the resource. Under such circumstances, we need to consider seriously whether it is the right moment to place lecture notes

on the Internet, given the limited benefit it will create. All the evidence point to the fact that this is not at all cost-effective.

Future Changes

Nevertheless, circumstances may change in the future with the further advancement and popularity of technology. This may occur when one or both of the following:

1. Most students can get access to the Internet conveniently (may be like the mobile phone) outside the university;
2. Students change their reading habit — when they like reading from screen instead of from print so that no hard copy will be required.

Alternatives

Using the Internet's interactivity as a tool is a definite advantage but this requires a greater sophistication which implies that there will be increase in costs. The only two advantages, if we can really find them, for having lecture notes on WEB pages are that students can access the notes outside university campus and that they can easily send mail to staff with the email addresses on the WEB page. To justify the use of Internet technology a lot more will be needed to make it attractive to students as an alternative to the static 'paper-based notes'. Interactivity, sound, graphics, animation, video that is, multimedia sophistication with carefully designed and authored materials would clearly be an appropriate development pathway. Whether the technology is up to it yet is worth looking at, and whether the cost required to produce such materials warrants the expenditure are questions worth analysing but well beyond the scope of this small study.

To streamline the development of Web Page materials and to provide increased functionality some of the following might be considered:

- only one page; with one to two short sentences as description; no pictures and no fancy layout — simple and straight forward development;
- lecture notes produced and made available in compressed format as well - download times reduced;
- email address of the staff displayed - simple form of communication between students and staff.

We estimate that the design of a simplified WEB page will take less than one working hour to complete.

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APPENDIX 1

BCO3146 Business Data Communications 2nd Semester 1996 Questionnaire

The purpose of this questionnaire is to help us to improve our current means of delivering lecture notes. Please spend a few minutes to answer the following questions. Please think carefully before you answer. Your response is most valuable to us and we thank you in advance for your co-operation.

Choose the most appropriate option for your own situation and then put a tick in the box •

1. *Do you know how to gain access to the Internet before you attended BCO3146?*

yes.

no.

2. *Can you access the Internet besides using facilities at the university ?*

no.

yes. Please state how

3. *Which method do you use to get copies of your lecture notes ?*

using the Internet to access web pages in the university.

using the Internet to access web pages at home

directly print the lecture notes it the university computer room.

download the files from the server to the disk, then print them at home.

download the files **AND** access web pages, then print them in the university.

download the files **AND** access web pages, then print them at home.

borrow hard copies from your friends and then make photocopies.

I never get copies of lecture notes.

*Using the above method, how many hours have you spent in obtaining 12 sets of lecture notes?
less than 1 hour.*

1-2 hours.

2-3 hours.

3-4 hours.

more than 4 hours.

4. *Do you read the content of the lecture notes briefly at least once on the Internet screen, before you print the lecture notes ?*

yes. I read it thoroughly.

yes. I glance through it.

no. I just print it directly from the Internet.

5. *Which way do you prefer to study your lecture notes for examination purpose?*

I read from the hard copy and underline the important points and make notes on it.

I read directly from the computer screen and never make hard copies for lecture notes.

6. *Do you think that lecture notes delivered on web page is a good idea ?*

yes.

no. Why ? _____

7. *Which of the following methods in delivering lecture notes do you consider the most suitable for you ?*

hard copies directly distributed to you from the lecturer.

borrow hard copies from your tutor/classmates and then make photocopies by yourself.

lecture notes on the file server and make copies by yourself.

lecture notes on the web pages so that you can access on the Internet.

notes in the university library reserve.

8. *If we are not going to supply you any lecture notes, but instead we print the whole set of lecture notes in the form of a text book and charge you at cost price, would you buy it ?*

yes.

no. Then how can you get a copy of notes, please state :

9. *Have you encountered any difficulties in getting the lecture notes using the Internet?*

no.

yes. Please state

10. *Any suggestions about the content or format of the web page?*

-END-

Thank you for the valuable time you spent on completing the questionnaire.