REFLECTIONS ON THE USE OF WEBCT IN LEARNING, TEACHING AND ASSESSMENT

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ABSTRACT

Economic pressures are leading to the adoption of on-line learning, teaching and assessment. This paper considers the tutors' and students' experience of the Virtual Learning Environment, WebCT, in the context of its use with large courses, meeting in class at De Montfort University. Performance issues, staffing and student assessment are discussed. The authors give thirteen recommendations for those who are considering the use of WebCT.

KEY WORDS

On-line assessment, Virtual Learning Environments (VLEs), WebCT

INTRODUCTION

With the continuing growth in student numbers, institutions and tutors are looking for techniques to improve efficiency of delivery of materials and assessment. Conventional web delivery lacks automated assessment facilities provided in Virtual Learning Environments (VLEs) such as WebCT. De Montfort University (DMU) uses innovative educational technology such as VLEs. Staff uptake with on-line learning tools has been limited. Currently some 25 modules are supported by WebCT, out of some 4000 modules at the University.

The paper is based on the authors' experiences of using WebCT at two campuses of DMU, Leicester and Milton Keynes (MK), in two first year Computing Science modules over 2 years with large, medium and small class sizes.

This paper evaluates the tool WebCT from both the tutors' and the learners' perspectives. It provides some background on VLEs and on practical issues and problems encountered. It offers solutions and recommendations for good practice, identifies advantages of using a VLE and suggests possible future trends.

BACKGROUND

Virtual Learning Environments (VLEs) and WebCT

VLEs often include course management facilities, student learning materials, monitoring facilities, assessment and conferencing. Tutors can select which facilities they wish to include for a module.

WebCT was developed in 1997 in the Department of Computer Science, at the University of British Columbia. 1n 1999 the company WebCT was set up. The WebCT VLE now has world-wide usage, and the company state there are student users at thousands of institutions, in more than 80 countries, (WebCT, http://www.webct.com).

Features of WebCT

WebCT includes four levels of user: Administrator, Course Developer/Designer, Teaching Assistant and Student. The Administrator can create a course/module on the server and set up student accounts. For each module there is a Course Developer who can load student learning materials. A module can have several Teaching Assistants which is useful with large student groups where staff are team teaching. Any number of student accounts can be set up for a module.

WebCT allows module materials created by the tutor to be made available to students, for example lecture notes and tutorials. There are also communication features, such as email (internal to WebCT), threaded asynchronous discussion, synchronous chat, a whiteboard and a bulletin board. Assessment is provided through formative and summative tests, called quizzes, providing a range of multiple choice question styles. Course and student management features include automated quiz score transfer, student tracking and student progress reports.

WebCT Administrator Features

The WebCT Administrator manages the installation and maintenance of the WebCT software on the server. S/he maintains the global database containing user names, WebCT user Ids and user types, and creates a course entity, which is then handed over to the Course Developer.

Course Developer Features

The Course Developer adds course content such as quizzes/tests and content modules. The Course Developer can also customise the interface to a limited extent, for instance colours, fonts and icons. Morss (1999) notes that this tutor control allows each course to use a subset of functionality best suited to the learning experience and teaching requirements of the tutor. Figure 1 shows the welcome screen/course homepage for module Using Computer Systems. This illustrates the page layout and icons selected by the Course Developer at DMU to lead the students to the various course activities.
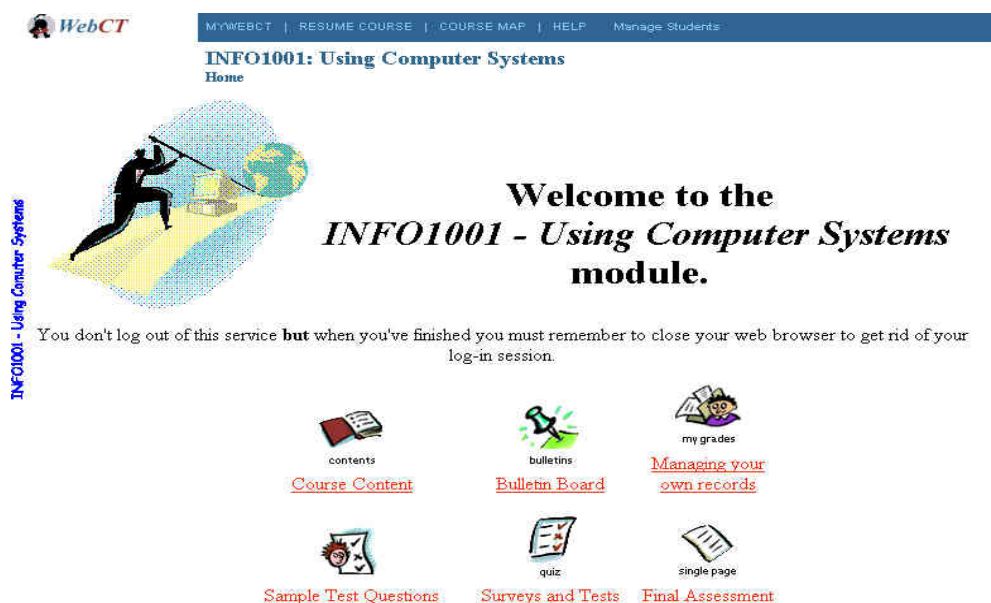

Figure 1. WebCT Welcome Screen for Module Using Computer Systems

There are also facilities to upload files, keep backups and for version tracking, which have a major impact on the robustness and usability of the VLE, (Ryan, Scott, Freeman and Patel, 2000). The Course Developer can include html and non-html files within the Content Module. An example of a Course Content screen for the Using Computer Systems Module in WebCT is given in Figure 2.

Figure 2. Course Content Screen for the Using Computer Systems Module

The Course Developer is able to manage student information, such as student grades and can control the feedback given to the students on test results. Tests can be made available for particular periods of time and results are then available to the tutor in a performance database.

Teaching Assistant Features
Teaching Assistants are able to monitor student progress on a course by tracking when a student last accessed the system and for how long. A picture can be built up of a student's frequency and duration of access, and of which parts of the system were used. A teaching assistant can also manage student data by producing class lists and result lists in a variety of formats.

Student Features
WebCT supports course content in the form of HTML web pages which can include links to external web sites, video and audio clips. A bulletin board is available for communication between students, as well as one-to-one communication via email within WebCT. A notebook allows students to save personal notes, whilst a Whiteboard provides a shared work area. Objective tests can be set and automatically marked, with results returned to the students immediately or later as specified by the Course Developer. From the students' perspective the features are comprehensive and effective.

WebCT at DMU
DMU is currently running WebCT Version 3.1.1.3. Six Educational Technologists support Faculty staff. Staff use of WebCT is voluntary and staff development and training sessions have been provided at regular intervals but mainly during term time so uptake of WebCT across the University has been limited. Currently there are 25 modules available and approximately 5000 students, out of a population of 34,000 students, are registered as users.
The authors have several years experience of using WebCT as tutors for the modules, Using Computer Systems and Computer Systems; they are based at different University sites.

Some Definitions

The authors use the following terms:

Term	Meaning	Comment
Large Class	More than 100 students studying the same module. Too many students to fit into a lecture theatre at the same time	Students are expected to attend class meetings – as if studying a normally delivered course.
Medium Class	Between 50 and 100 students – could be fitted into a lecture theatre	When using WebCT they will be placing a significant load on the server – a load which is very high when running tests.
Small Class	Under 50 students	
Laboratory Class	Under 20 students	
Concentrated Class	Students assemble in rooms and lecture theatres – as in conventionally taught classes	Classes may have to be scheduled so that few lab classes are concurrent.
Distributed Teaching	Students work on their own and normally do not gather into a concentrated class.	Students work at a time of their choice, which lessens the loading on the web server.
Remote Study Centres	Students concentrated in several distributed locations to study the same course.	This enables a University to franchise a Concentrated Class course to several distributed Campuses (as at DMU) and facilitates the support of franchised courses.

In 1999/2000, a large class of over 280 Year 1 students studied the Using Computer Systems Module in Leicester; a medium sized class of approximately 80 students at MK and a small class of approximately 20 students at a remote study centre studied the Computer Systems Module.

The Using Computer Systems Module was developed with weekly lecture, tutorial and laboratory sessions. This reflected the structure of a conventionally delivered module in a concentrated class. Powerpoint slides relating to each lecture were available on the web but this resulted in reduced student attendance at the lecture so that many students missed important material delivered in person by the tutor. The problem of non-attendance and relying solely on material provided by WebCT is also reported by Brown (2003). However, in a study with Pharmacy students using WebCT, Andrew (2001) did not encounter this problem, even when the slides were made available to the students before the lecture.

The laboratory sessions in the Using Computer Systems Module were designed for students to work through Computing exercises on the WebCT based course. However, many students spent their class time exploring WebCT (which could have done in an unstaffed session) rather than using the tutorial help available to complete the exercises. New students would benefit from longer staffed laboratory sessions. Close support becomes less necessary when the student has gained experience of using WebCT. It is our view that it is inappropriate to simply replicate the traditional delivery mechanisms when designing a web-based module. Saunders and Klemming (2003) note that there is understandable concern that rapid and widespread adoption of technological approaches could fail as a consequence of the inability of many teaching staff to adapt their teaching to suit a technological environment. Students started the course using Windows–based PCs and half-way through were transferred to Unix machines. This platform independence allows an institution greater flexibility and gives more experience to Computing students.

In the Computer Systems Module at MK WebCT quizzes were used for summative assessment.

ISSUES, CONTROVERSIES, PROBLEMS

Computing Resources Required - Original and Current Configuration at DMU

Initially the server on which WebCT was installed at DMU, Leicester, also provided other services. As performance was found to be unsatisfactory it was upgraded to a dedicated server with the following specification:

> Dell Poweredge with dual Intel Pentium III (700MHz) processors and 1 Gigabyte of memory and a 16 Gigabyte hard drive running under the Red Hat Linux operating system with the Apache web server software.

Linux was adopted after comparative performance trials with other operating systems.

In MK there were problems with speed of access. The system was very slow when the students logged on for a test and at the end it took nearly 5 minutes to acknowledge that 'Finish' had been pressed, (Abraham, Constable, Kiely and Richardson, 2000). Sufficient time must be allowed not only to complete the test, but also to log on and off. This needs to be carefully planned if different shifts of students are taking tests. It was therefore decided that a central schedule would need to be kept, to restrict the numbers of students taking tests simultaneously. The system was observed to be slow in acknowledging students' answer attempts. This was frustrating for the students and necessitated a longer test time.

In Leicester access was almost impossible whilst the tests were being taken at MK. The poor response time was disliked by the students, (Burns, 2001).

It should be noted that with the last upgrade of the server to the present configuration (see above) the response time was found to be much improved.

Key Staffing Requirements

The Administrator needs to have specialist knowledge of the operating system, to have a sound knowledge of WebCT and to be available to provide support throughout the academic year. This is especially necessary at the start of a course to create student accounts giving student access to WebCT via a user ID and password. Williams (2002) strongly supports the availability of dedicated technical assistance, which he believes would have helped avoid the numerous technical and access difficulties encountered at the University of North London, in an initiative using WebCT to disseminate pedagogical materials.

The Course Developer needs to have good computer skills and be familiar with the world wide web. The Course Developer requires knowledge and training in the facilities of WebCT, experience of effective course design and substantial development time. The skills of the Administrator and Course Developer are essential and difficulties arise when staff leave. Several staff should be trained in these roles to provide back-up.

Course Development

A long lead time is required. The environment needs to be set up, with a welcome/home page, and the icons for the required features. Time is required to structure and load materials. In 1999 the Course Developer of the new module Using Computer Systems dedicated the entire summer vacation to preparation. Ryan, Scott, Freeman and Patel (2000) suggest a year's lead time for developing a good web-based course. We believe that this is realistic. Brown (2003) also reports on the significant time required to update/reset the site each year, maintain the site throughout the year, adding new materials, removing unwanted materials, check discussion forums and so on.

It is also desirable that the development of a full module using WebCT should involve team consultation and scrutiny. Once developed, the course could be used for several years but maintenance by the Course Developer will be needed throughout the life of the course particularly if it is a rapidly evolving field of study.

WebCT is described as comprehensive, but easy to use, (Evans and Nation 2000); this is supported by Morss (1999). Ryan, Scott, Freeman and Patel (2000) also note that a variety of interactivity can be supported at a technical level relatively easily.

User Set-Up

Each student user requires an account and a user-id to use WebCT. When dealing with hundreds of students the bulk creation of WebCT accounts caused a significant problem. An issue we encountered in using WebCT in the Year 1 Semester 1 module, Using Computer Systems, at Leicester was the delay in getting student data from enrolment to the point where students had their own user-ids for WebCT. There are three options available for the creation of accounts:

1. To allow students to create their own accounts;
2. To bulk upload accounts from a file;
3. For the WebCT Administrator to manually input all the accounts.

The first option is not enabled at DMU and is undesirable as data would be inaccurate and inconsistent. The third option is unrealistic for other than small numbers of students. The bulk upload option is most practical and requires a source file of students taking the module. The long processing time of enrolment data using the DMU central student data system caused significant problems and a delay in student access to WebCT. Fortunately, an alternative local admissions database was available to create a student list more quickly which was later reconciled with the University's central student data system.

The Tutors' Perspective on Assessment in WebCT

We believe that a web-based course should be supported by a well-structured textbook. Many introductory-level textbooks contain suitable multiple choice questions: this provides a cost-effective way for course developers to build a question-bank. In the test for Computer Systems many of the questions were based on those from a Teacher's Supplement for the main course text. The three tutors for the module were able to contribute and inspect the questions remotely, (Abraham, Constable, Kiely and Richardson, 2000).

Similarly in the Using Computer Systems Module tests, the teaching resource pack for the set text, Stern and Stern (1996), included a bank of multiple choice test questions; about 1000 questions were used in total. In WebCT a batch upload utility can be used to load the questions quickly.

The Course Developer for Using Computer Systems used the WebCT Question Set utility, to select questions at random from a pool, to generate sample tests for students, to enhance their learning and familiarity with the WebCT environment. He found this facility useful and efficient.

The setting of multiple choice questions (MCQs) in WebCT was not found to be difficult, though Siekmann (2001) notes that the question creation interface can be complex for first-time users.

There is a range of possible question types such as MCQs with one or more correct answers, short answers (fill in the blank), matching and calculated. WebCT is not able to search open-ended questions for keywords. For a greater variety and more sophisticated question types a dedicated tool such as Question Mark Perception could be used. Questions generated in such tools can be accessed through the WebCT environment, providing greater flexibility.

The tests in WebCT can be scheduled for a selected date and turned on and off This was found to be a useful feature for formative sample tests, which could be available at all times and for summative tests which were made available only for the planned duration of the test.

An issue reported by the Course Developer of Using Computer Systems was that students spent a lot of time, even in class time, on the sample tests rather than working through lab material for that session. He suggested that ideally the sample tests could be turned off during normal office hours. However, this could not be automated in WebCT and turning several tests off and on manually was too time-consuming.

The privacy of each student's tests is well supported as each student is offered a different random combination of questions from within a category set.

The testing and record keeping facilities offer an advantage over conventional web-based courses. However, this is countered by the need to supervise students during tests.

Currently at DMU there is no implemented facility for electronic exchange of student data, such as marks, between WebCT and the central student record system.

Assessment Invigilation
It was recognised that any summative assessment in WebCT required invigilation to verify that the correct student was taking the test. We needed to ensure that a test was taken by the named student and not by a friend. Hence, tests were conducted in concentrated classes, in class time, with a tutor present to invigilate and register students. The register list was then reconciled against the time-stamped test submissions and marks recorded by WebCT. This proved to be a time-consuming and unproductive task for the staff. This highlights a weakness in using web based assessments for distributed courses.

Siekmann (2001) recommends increasing on-line test-taking security, by making quizzes available based on IP addresses (which identify each computer in use) in addition to password protection to constrain test-takers to using a particular computer. Roscoe (undated) also notes that there are many questions that need to be answered with respect to security of assessment if it is done remotely.

The Students' Perspective on Assessment in WebCT
The provision of sample tests was popular with students on the Using Computer Systems Module in Leicester and the students liked getting immediate feedback on tests (Burns, 2001).

A practice test was set up for the MK students taking the Computer Systems Module which was run a week prior to the 'real' test. Student feedback, via questionnaire, indicated that they found this reassuring and a valuable experience, (Abraham, Constable, Kiely and Richardson, 2000). 95% of respondents reported feeling in control, 92% also reported having adequate scope to check and modify answers. When a question has been answered a dot turns from red to green, but if a student changes their answer the dot remains green. There was concern that some mechanism was needed to indicate that a changed answer had been recorded. This is important for informing and reassuring the user.
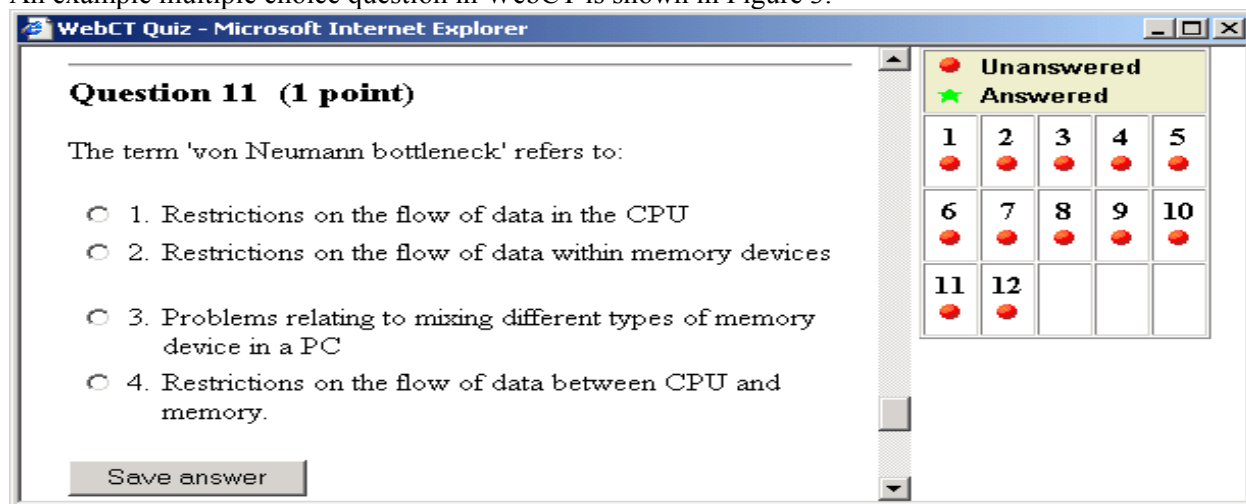An example multiple choice question in WebCT is shown in Figure 3.

Figure 3. Example multiple choice question used in the Computer Systems Module

Necessary Computer Skills for Student Users
We are working with Computing students to whom using a computer is normally second nature. Consequently, students did not report any concerns about *using* the system or highlight that significant computer skills were needed to use WebCT.

Students' Experience of Using WebCT

Flexibility

Burns (2001) reports that analysis of a student feedback questionnaire on the effectiveness of WebCT on the Using Computer Systems module, at DMU, Leicester, showed that the most positive perception was flexibility and accessibility. The authors' experience supports this.

Motivation

Andrew (2001) reports that Pharmacy students found a WebCT course "an excellent and unique learning experience that gives more interesting and fun tuition than everyday lectures."

Effective Learning

In the research study by Abraham, Constable, Kiely and Richardson (2000), the test results of the MK students taking Computer Systems were evaluated and the WebCT technology did not seem to produce any negative effect on student performance. This is supported by Morss (1999) who reports the consequences of using WebCT did not seem to place any unwanted burden on the students. In the MK study, one dyslexic student commented that using computer based assessment had provided a 'more level playing field' in which he could demonstrate his knowledge alongside other students.

Andrew (2001) notes that his Pharmacy students were better prepared for Microbiology labs and worked more efficiently and enthusiastically with WebCT-supported learning. Goldberg (1997) notes that students found the conferencing facility and the on-line course notes very useful.

Andrew (2001) reports an improvement by one student cohort in numeracy. For three weeks students used a 'Microbiological Calculations Tutor' set up in WebCT. In the unseen end-of-module examination two months later, where similar calculations were required, this skill was retained. This study did not include a control group for comparison, so the results are interesting but must be viewed with caution.

Concerns

Many students preferred to use email systems available on the Faculty PC and Unix networks rather than the internal WebCT email facility. Students did not always check their internal WebCT email and this caused difficulty in communicating with students. Burns (2001) reports that 42% of students did not see the WebCT VLE as an effective means of communicating with the tutor. Andrew (2001) reports a student suggestion "an email link within WebCT to contact the lecturer directly rather than going to the discussion group". Both authors report on the use of WebCT in concentrated classes; WebCT's email and bulletin board may be more relevant for distributed classes.

An issue raised by Morss (1999) is the preference by his students to read from a text, rather than the WebCT screen. Saunders and Klemming (2003) also note students reporting that reading on screen was uncomfortable and limiting. We suspect this to be true for many people, as reading from hard copy often causes less eyestrain than reading from a screen.

Burns (2001) notes that students on the Using Computer Systems Module reported that the response time was too slow, which is a major concern.

Further Use of On-Line Learning Tools

Abraham, Constable, Kiely and Richardson, (2000) report that the students strongly support the continued use of computer-based assessment. However, Burns (2001) reports that nearly half the students had a neutral view on the continued use of WebCT, where it had been used for more extensive support of the module. Andrew (2001), using WebCT to support Pharmacy students, reports that about half of his students agreed or strongly agreed that they liked learning this way in 1999/2000; this rose to nearly two thirds in 2000/01.

In his earlier article, Andrew (2000) identifies a rising expectation of students to use technology in their learning. Morss (1999) also reports that the students could see the value of using WebCT in gaining experience in such technology.

Staff Development and Training

Ryan, Scott, Freeman and Patel (2000) and Evans and Nation (2000) recommend that significant resources need to be allocated to staff development in the use of educational technology and to supporting staff in using it. This is essential to encourage uptake and ensure sound educational practice.

SOLUTIONS and RECOMMENDATIONS

Purpose

We recommend:

- If individual student testing, communication and management features are required to support web-based learning an institution should consider the adoption of WebCT.

System Specification

We recommend:

- A dedicated high speed departmental server is required for acceptable access/response time and system usability;
- The required performance level of WebCT should be specified by an institution and performance loading acceptance trials done;
- For large concentrated classes, scheduling of sessions and of student tests (quizzes) is an important consideration with regard to load on the server;
- A reliable and efficient technical infra-structure is required to support the operation of WebCT throughout the life of a WebCT course.

Student Account Creation

We recommend:

- An institution should provide accurate module cohort lists before the start of any semester for bulk account creation. The alternatives would be to use conventional web technology instead of WebCT or to avoid the use of WebCT in the first 4 weeks of year 1, semester 1.

Assessment in WebCT

We recommend:

- Summative assessment through quizzes in WebCT requires invigilation, as it is essential to verify that the correct candidate is sitting the test. The invigilation may be by the tutor who knows the student by sight, or by a non-academic who can authenticate the student via a student id card including a photograph.

Staffing

We recommend:

- Course Developers should have time in which to develop a course; the lead time may be as much as a year;
- WebCT Administrators and Course Developers should be available for maintenance throughout the life of a WebCT course.

Course Development

We recommend:

- Course Development should be open to team consultation and scrutiny;
- Avoid scheduling lectures and tutorials which only replicate material on the web.

Training

We recommend:

- Staff development to enable staff to adopt appropriate and effective learning and teaching styles for use with tools such as WebCT;
- Students should be given an introduction to the features and functions of WebCT.

FUTURE TRENDS

As noted earlier, the use of WebCT has rapidly grown. The leading British competitor, Teknical, is increasing its market share internationally, with their VLE, Virtual Campus, (Teknical, http://www.teknical.com). We expect this growth to continue over the next few years.

Good communications links between web-servers and users are necessary either by cable or, where cable links are not economic, by satellite. The current drive towards cable will facilitate greater use of web teaching but this will not necessarily reach rural areas. The wider use of satellite communications to service remote areas will be necessary.

With widening internet access, life long learning and increasing numbers of mature, distance and disabled learners, electronic education has to grow. Use of web-based learning and in particular the feedback obtainable from formative assessment, such as the quizzes in WebCT, will help develop the confidence of the returning learner.

WebCT is a good vehicle for the delivery of a course at a remote study centre, for example, to support a franchised network of colleges. With the increase of student numbers wishing to study at their local college, this provides better access to higher education.

British Government intentions to have 50% of school leavers going into higher education means efficiency savings in learning and teaching styles and assessment will be essential. The need for technological support through VLEs will continue. Our institution is encouraging innovation in teaching and learning support using educational technology.

An issue of concern with VLEs is the confidence which can be placed in summative assessment. We consider it essential for the student taking an assessment to be physically seen to be doing so to avoid cheating. Future IT developments in biometric data recognition, for example eye scan or fingerprint recognition may be of help in this area.

CONCLUSION

With increasing student numbers and a greater diversity of students with many demands on their time, there is a greater need for flexible approaches to study. VLEs such as WebCT provide such flexibility. In our experience students have appreciated the 24 hour availability of module resources through WebCT and have benefited from the automated formative assessment with feedback. The VLE has augmented the traditional classroom learning and teaching environment.

Our experience of WebCT has been in concentrated classes. We assume that many of the problems of server overload would be less apparent if WebCT was used in distributed teaching, with users making sporadic use of the server.

From the tutor's perspective WebCT facilitates the creation of a sophisticated VLE, by non-technical users. Some operational difficulties were encountered and solutions and recommendations have been made with respect to these. We believe that initial tutor training is required and on-going technical support.

We note that WebCT has some advantages over conventional web-based learning. The self-tests and quizzes are useful to enhance student learning and progress checking. WebCT aids the tutor with automated marking and feedback, a significant benefit with large student numbers. The communication features would support a distributed learning community, enabling them to work collaboratively, but this is less relevant to concentrated classes. An institution needs to balance direct and indirect costs of a VLE, such as WebCT, against potential benefits to establish the 'added value'. The authors' believe that the more costly, specialised VLE is appropriate only when facilities are needed that are not available from a conventional web.

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