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Continuous Improvement in e-Learning: Investigating the Effect and Impact of Our WebCT Chemistry Support Initiative (CSI) and Implications for Further Enhancement of the Virtual Learning Environments (VLEs) Developed.

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Abstract

A Virtual Learning Environment (VLE) was developed using WebCT software and was piloted in 2004 in the School of Chemical and Pharmaceutical Sciences in DIT by the authors. This was one of a number of measures introduced with the aim of supporting and retaining first year undergraduates on the Science ordinary degree programme and was designed as a Chemistry Support Initiative (CSI) for first year Chemistry learning and teaching (O'Connor, 2005). This work was supported through funding from the DIT Learning and Teaching Centre which allowed a summer research assistant to be taken on.

Since the launch of the first WebCT VLE in our School in September 2004, a VLE has been created for each year of each programme we deliver. This was facilitated by the fact that the first WebCT template design could be adapted quite easily and that first year students expected to continue to have a VLE available as they progressed. Currently, VLEs are used to support undergraduate Chemistry students from their first to their final year. WebCT has also proven to be very effective in the support of taught postgraduate programmes (both full and part-time) and as a tool for the administration and management of our School through the use of a WebCT site for staff. Now in the third year of use, the level of integration of WebCT VLEs in our School has been evaluated to assess the current (i) use by staff and (ii) use by students. The research is aimed at providing guidelines for the development and utilisation to their full extent of the existing VLEs and optimising their pedagogical application in a 'blended approach' to learning and teaching chemistry. An investigation has also been carried out to discover what other applications of the VLE have been developed by individual members of staff and what affects staff participation in e-Learning.

As part of the evaluation process, the types of VLE developed in our school will be examined as will their impact on learning and teaching. This paper seeks to examine the development and integration of VLEs in our school and to identify pedagogical applications of this learning tool for future learning enhancement.

Introduction

Michael (2001) recommends that teaching staff should be encouraged to approach their teaching in the same way that they carry out research. This requires investigation and evaluation of new methodologies for teaching and learning. The use of information and communication technology (ICT) to support learning and assessment is one such developing methodology. A project was initiated in the School of Chemical and Pharmaceutical Sciences in June 2004 to use WebCT software to provide a virtual learning environment (VLE) for first year undergraduate Chemistry students enrolled on an ordinary degree programme in Science. This was one of a number of measures implemented to provide additional support to the students enrolled on this programme. The VLE developed provided access to programme information, past exam papers, tutorial problem sets, summaries on certain lecture topics, a glossary of chemical definitions, useful websites, careers information, an academic calendar, WebCT mail and a series of formative self-assessment quizzes that provided instant and

detailed feedback. To avoid confusion, care was taken to ensure that this VLE was similar in layout to the one that had already been developed for the same students for Physics.

Halfway through the first year of use of our Chemistry VLE, the authors decided to adapt it so that it could be used for students in Second Year of the same programme. It was relatively easy to request that a copy of the existing VLE be made and we then modified it as necessary. Since then, a VLE based on the original template has been developed for all years of all undergraduate programmes delivered by the School. The VLE's used for taught Masters programmes have their own template however.

Evaluation of Current Use of WebCT by Staff

WebCT has been incorporated into each year of every programme in the School of Chemical and Pharmaceutical Sciences as a Virtual Learning Environment (VLE) for students on the programme. The academic staff of the school were surveyed using an evaluation questionnaire containing some open-ended questions. The following are the preliminary results of our findings of the staff currently using/ not using WebCT. The results will be discussed under 7 headings.

'The increased use of VLEs presents challenges to support structures, staff development and institutional policies. For staff to use and to sustain this use, online learning developments need to be perceived as relevant, easy to use, accessible and embedded in a supportive institutional environment that rewards and encourages flexible learning developments' (Collis & Moonen, 2001; Browne & Jenkins, 2003).

Results of Staff Using WebCT

1. Motivation for adoption:

To ascertain the reasons why staff got involved with WebCT and why it was implemented relatively quickly by most staff members they were asked 'What motivated them to get involved with WebCT?'. The following are examples of feedback from staff teaching on full-time undergraduate programmes.

- *'Interested in learning about the new technology as I have never used anything like it and I wanted to see how it could be used to support learning and teaching for undergraduate students'*
- *'Coordinated another first year group who already had a WebCT site for another subject (Physics) and got a Learning and Teaching grant money with a colleague to develop a WebCT site and quizzes for first year students. Also, I had used WebCT in the Learning and Teaching Centre and could see it was useful.'*
- *'Positive impression from colleagues, expectations of students, makes life much easier.'*

The comments from staff show that it was based on a personal interest to get involved and none of the staff were influenced by a school or management decision in this case. The influencing factors stem from an interest in the technology to support students learning and teaching, positive impressions from colleagues in the faculty already using it, being a student user on the Learning and Teaching Centre programme and student expectations once introduced to VLEs.

What comes across in general is the use of the WebCT as a programme administration tool and a communication tool. In particular one academic member of staff has the responsibility of coordinating the third year students' industrial work placement which is facilitated by WebCT. 'It is a very useful tool for communicating with large disparate groups' hence the class who were based in approximately 30 companies nationally were contacted via WebCT mail and the students found it useful to contact each other over the 6 month work placement via WebCT.

However convenient staff may find the system there are negatives e.g. *'e-mail is separate from Microsoft outlook and requirements to upload documents is cumbersome. Management of students is not easy.'*

For staff coordinating part-time taught postgraduate programmes their motivation was to use the VLE for; (i) making programme material available to students,
(ii) use as a remote learning tool,
(iii) the discussion board functionality, and
(iv) storing module and programme information.

The applications for part-time advanced students are different to those for the undergraduate students and this is to facilitate more mature students in their life long learning as they are taught at night and weekends and want 24-7 access to their programme material.

2. Resource Implications

There are 250 undergraduate students currently studying Chemistry in the School full-time and 89 taught postgraduates part-time and the numbers do not include the large amount of service teaching that is hosted for other schools (Physics, Biological Sciences) and faculties (Food and Tourism). Some of the service teaching programmes are also supported by the VLEs developed in our School.

"With greater use of WebCT, there will be a greater pressure on access to the system perhaps requiring more student facilities".

The School currently has one computer room which has 20 computers with internet access for student use and one computer for the lecturer. All computers were replaced in January. There is access to one printer in our computer room and other than that there are printing facilities in the library. The students have poor Wi-Fi access on the floor where our school is located. However, they do have Wi-Fi access in most other areas of the college.

3. Training and Support Required

'I attended 'Introduction to WebCT', 'Advanced WebCT-Using WebCT to best effect as a lecturer' and 'Effective Assessment with WebCT'. The courses were run at different locations across the DIT and we also had in-school training.'

Most members of staff received their training on courses run by the DIT Learning Technology Team (LTT) either off site or in-school. The in-school training was requested by one member of staff and was run in our school computer room over 6 weeks at lunch time by the LTT specifically for our applications which about 60 % of staff attended. The comments received showed that the general consensus was that one day training was not sufficient and the training carried out in-school over 6 weeks was sufficient. As can be seen from the comments below the timing of the course is significant for WebCT users as it is not a user-friendly system.

- *'Received introductory training. It was good and covered all aspects, but I find learning by doing is best once basics are covered.'*
- *'Training was fine, but I did not use it straight away so all was forgotten by then.'*
- *'As with any training it is important to have it at a time when you want to use it and that was the case for me.'*

One or two new members of staff have not been trained formally yet by the LTT due to time constraints. Individual members of staff also rely on trouble shooting carried out over the

phone with the LTT to support the maintenance of their VLEs. Peer tutoring from colleagues in their school helps as well as trying to work it out individually.

62 % of the current WebCT users in the school felt that they did not require additional training however they would avail of over the phone support offered by the LTT as needed. If a new version of WebCT is launched then they will attend training for that. 38 % would like to attend more courses for different reasons such as: (i) to use more functionality, (ii) to extend their current use of WebCT, and (iii) to learn from others and how and why they use WebCT.

In terms of looking to the future of WebCT in the school the feedback showed that 63 % of the current users wish to extend their use of WebCT. Applications they wish to learn more about are the use of:

- My grades – for formative assessment results
- Quizzes (especially uploading from Respondus)
- Discussion boards
- Interactive sites – simulations/ animations
- E-packs to enhance visualisation of programme material and provide support material.

4. Current Use of WebCT Programme Management

The main applications of WebCT in VLEs currently in the school are listed below. A lot of the applications facilitate effective programme management as all contact and messages are archived in one central point. A list of applications was given to the staff to highlight which applications of WebCT they use on their VLE and the results are given in Table 1.

- (i) Uploading programme material
 - Lecture notes*
 - Tutorial Sheets
 - Assignments
 - Past Exam Papers
 - Guidelines on Project Preparation
 - Information on Community Learning
 - Assessment Criteria
- (ii) Contacting students by WebCT mail
- (iii) Interactive Chemistry Crosswords (aimed at first year students)
- (iv) Formative Assessment quizzes (aimed at first year students)
- (v) Calendar entries
- (vi) Distribution of grades
- (vii) Feedback on assignments and grades
- (viii) Discussion boards.

The results in table 1 show that the VLEs are mainly used for programme management, posting of relevant documents and communicating with students through the WebCT mail and calendar. However, the more interactive and distinctive applications such as on-line learning activities, on-line assessment and discussion boards are not as widely used. 'Peer tutoring' from colleagues currently using such applications may facilitate more staff using them. A school WebCT half-day workshop might be appropriate for such information transfer.

Table 1: Percentage of staff using the various WebCT application tools.

| WebCT Application Tool | % staff using tool | WebCT Application Tool | % staff using tool |
|------------------------|--------------------|-----------------------------|--------------------|
| Programme management | 88 % | Handouts | 88 % |
| Discussion Boards | 38 % | Tutorial Sheets | 88 % |
| WebCT mail | 75 % | On-line learning activities | 38 % |
| Lecture notes | 63 %* | On-line assessment | 12.5 % |
| Calendar | 88 % | Simulations/ Animations | 25 % |
| Quizzes | 50 % | Others | |

* Only for final year students and part-time taught postgraduate programmes.

In terms of useful pedagogical applications of the VLEs the staff felt that the assignment tool with formative feedback, interactive crosswords, posting of weekly tutorial sheets for first and second years, study skills presentations and career profiles were useful for students to reflect on in their own time. Also more use of the discussion board would be encouraged but from our limited experience both staff and students are reluctant to use them to a great extent and may need training. Additional interactive links and the glossary on the site are a useful resource.

School Management

The School WebCT site has proven to be a very useful administration tool. The main uses for this site are as a documentation repository. Such documents include; minutes of meetings, programme documentation (module descriptors), and assessment regulations etc. Comments from the staff in relation to the school WebCT site are as follows:

“It is a central point where reference material can be maintained/ updated as applicable”

“1300 hits from staff in the last year, 5 staff not logged on yet”

“Yes it is useful, but some of the documents are out of date i.e. most recent version of some programme documents. Handy reference library for minutes of meetings”

Currently the design and maintenance of this School WebCT site is the responsibility of one academic member of staff. The School WebCT site was launched this academic year (2006/2007) to assist a programme review and there are 20 of the 25 academic members of staff using it.

5. Level of Interactivity:

‘to use the web as simply a coat hanger where files are left for students to access will not engage students and thus be counter productive’ (Broad, 2004)

The term interactivity may have been misconstrued to mean the amount of WebCT usage instead of the actual interaction required from a student with the VLE. Young and Kornblith, (2006) gave examples of the interactivity to look for in e-packs.

‘case studies, games and simulations at a level that should require input and actively engaging students in a learning process.’

Some of the staff replied that the level of activity was based on how regularly students logged in to the VLE. However, some of the existing users are making efforts to enhance the interactivity of the VLE.

- *‘High when using discussion board, crosswords or quizzes.’*
- *‘Basic interactivity in terms of quizzes, crosswords and links to interactive websites, but I have not developed animations/ simulations myself.’*
- *‘Low; students mainly use e-mail except for on-line assignments.’*

6. Management of VLE

In our school most of the programme coordinators or a responsible person are the VLE designer for the year and programme they are coordinating. Other users can send their material to the VLE coordinator for uploading or ask to be given designer status also. In summary of the staff currently using WebCT only one person is not a WebCT designer. This VLE management system is created by the users. In the future it would be preferable that all the teaching team on that programme year to be added as students so all can view what the students have access to. Designers feel that WebCT is a very cumbersome system, especially as it is not Microsoft compatible. For many designers the programme template was already designed.

In terms of time employed in maintaining the VLEs most designers would access it on a weekly basis and would spend on average 1 to 3 hours a week uploading/ maintaining the site. Another designer who has experienced using discussion boards required 2-4 hrs per week when using a discussion board. As an exception one member of staff uploaded all of the material required for a mature student part-time programme last year and has not accessed the VLE at all for this academic year.

7. Constraints and Problems encountered:

'Time is perceived by staff as the major inhibiting factor to e-learning.' (Oates, 1999)

The main factor arising with staff as an issue with WebCT is time. Nearly all users complained of the time it takes to upload onto/maintain a VLE.

- *'One by one uploading/ managing is ridiculously primitive even with Netdrive!'*
- *'Uploading and removal of material takes too much time when using the site regularly.'*
- *'Having the time to upload quizzes and write messages on discussion boards.'*

Other issues arising with WebCT are adding staff as students/ teaching assistants. Some staff expressed that the current programme template is limited in terms of how material is presented as a list under module title for programme year. Students forgetting passwords is annoying especially if you try to do a large group interactive workshop. The staff feel in general that WebCT is not intuitive so if you are not using it regularly it is not very user-friendly. A 'save-draft' option on the discussion board would be useful. It would be useful to have the WebCT mail linked with Microsoft Outlook and if WebCT was more Microsoft compatible. It is hoped that the new version of WebCT will have less of the problems mentioned and be more intuitive.

Benefit of VLE

In general all staff agree that the VLEs are *'useful for students providing they use it regularly'*. It is easier to communicate with a class of students and make sure all are up-to-date with assignments and lecture notes. Programme information is easier to locate and access and communication with programme coordinators is also easier using WebCT mail for full and part-time students.

'Use for programme management is very beneficial.'

Results of staff NOT using WebCT

Approximately 20 % of staff in the school is currently not using WebCT directly as a VLE. However, 60 % of that 20 % are currently using our school staff administration site which was created using WebCT. On viewing the comments for staff on why they are not using WebCT in table 2, it is hoped that in the year ahead all teaching staff on relevant years will have a

minimum of student access to view what has been uploaded and the applications of WebCT they may use in the future. None of the staff currently not using WebCT felt that their students were at a disadvantage. Of the staff surveyed who are currently not using WebCT only one felt they would not like to use it in the future. This individual felt that they had done all the courses but were unable to get a grasp of WebCT. The other members of staff felt that they would all like to use WebCT in the future. Examples of what they would use it for are; uploading lecture notes, showing 'real-time' simulations, assessment, giving information to students and preparing on-line courses for students.

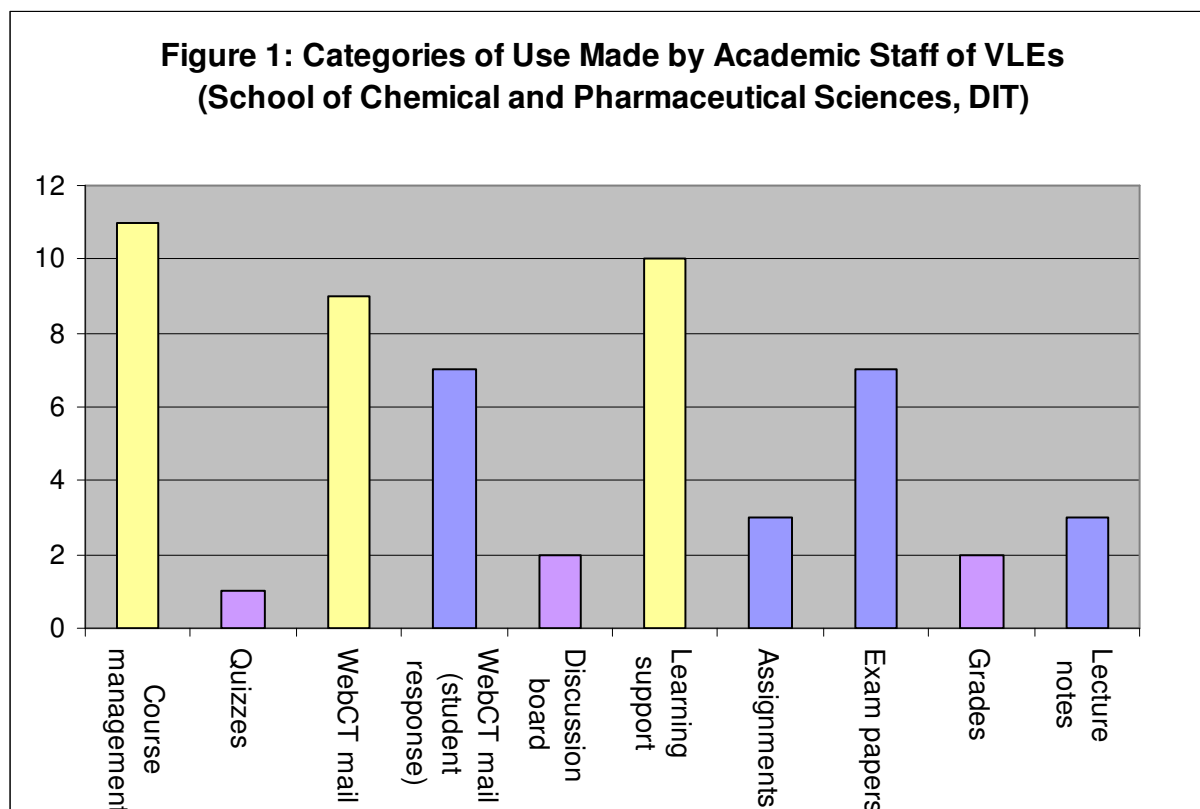
Table 2: Comments on issues preventing staff from using WebCT and suggestions to overcome the issues.

| Reasons for not using WebCT | Suggestions to overcome the reasons |
|--|---|
| <i>"Do not know enough about it"</i> | <i>"If one had access to current programme/ student WebCT it would help in learning more about WebCT"</i> |
| <i>"Not familiar with the system"</i> | <i>"taking time to learn how to use it"</i> |
| <i>"Stress"</i> | <i>"None"</i> |
| <i>"Lack of time prevents me from loading material onto WebCT"</i> | <i>"Introduction of small portions of programme gradually"</i> |

Review of the VLEs

A review of the VLEs that are used with each programme was performed. There are 11 in total. They were assessed to determine which categories of use they belonged to. The categories identified were, course management, WebCT mail communication, learning support material, interactive quizzes, discussion board use, provision of lecture notes, provision of exam papers, assignments, grades.

The main areas of usage by staff were course management (100%) and learning support (91%). Provision of exam papers (64%) and use of the WebCT e-mail were other common features in the VLEs. WebCT mail was used in most cases but the percentage of use which involved students responding to e-mails was 64% and, for a further 18%, e-mails with course-related information were sent by academic staff but students were not replying. The more interactive features of the VLE were not being used to the same extent; quizzes (9%), discussion board (18%), assignments to be downloaded and submitted (27%) and notification of grades (18%). Lecture notes were posted up for students on the taught masters courses and the final year of one undergraduate course. This represented 27% of the VLEs. It was also noted that a chat feature was enabled on one of the VLEs for a taught masters course but it wasn't being used. Also, it was found that one group of first year students were using the calendar to highlight when their birthday was. This information is represented in chart format in Figure 1. These results from the review carried out on the VLEs are very similar to the data presented in Table 1 which summarises responses given directly by staff on the applications they use VLEs for.

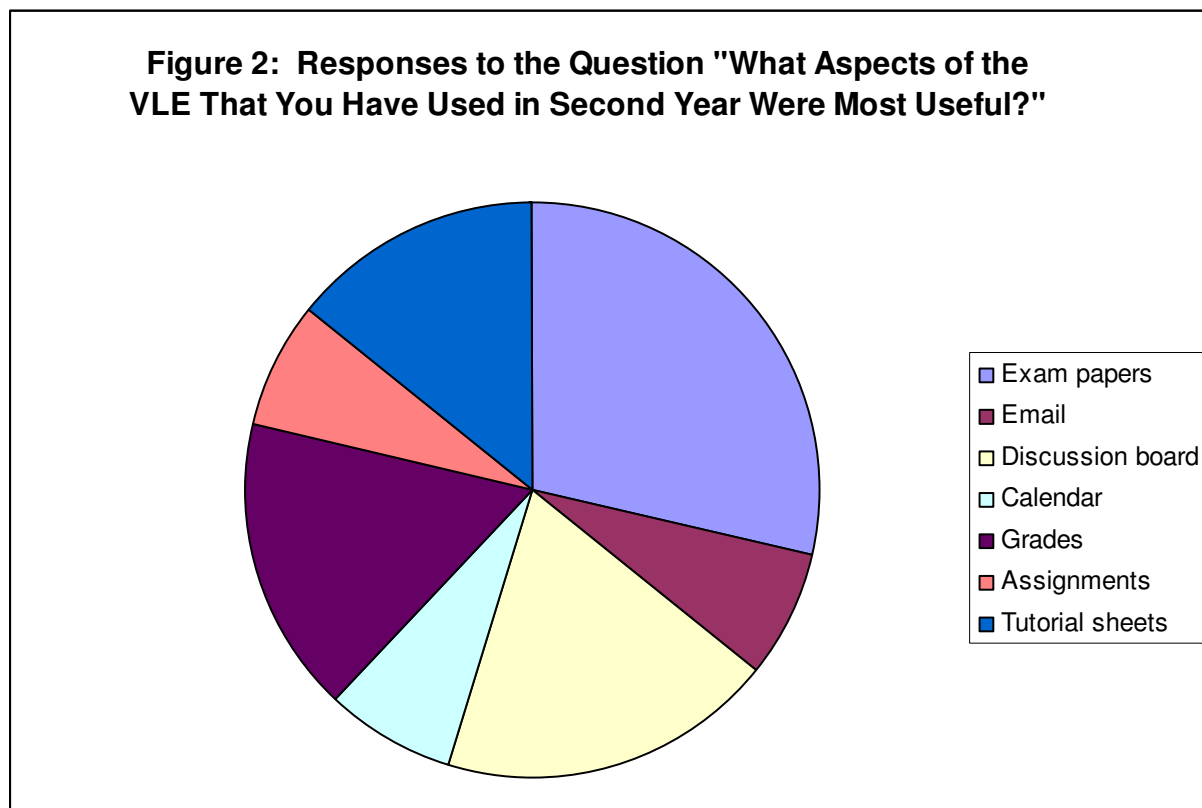


Evaluation of Use of VLEs by Our Students

An evaluation questionnaire was completed by 14 second year students. A series of questions, some open-ended, were asked to find out what aspects of the VLE available to them they found useful in first and second year. They were also asked about what other features they would like to have available and what were the benefits and disadvantages of using the VLE. This group of second year students was selected to be surveyed because they had had the opportunity to use the greatest number of aspects of the VLE (calendar, WebCT mail, discussion board, assignments, grades, quizzes, use of learning support material). It is planned to extend this student survey to other groups of students next year. In addition, each cohort of first year students on the Science ordinary degree course for whom the original Chemistry VLE was developed are asked several questions on an evaluation form every year to establish what they found most useful about the VLE and the authors have obtained some feedback from students informally by asking questions about the effectiveness of the VLEs during their teaching contact time. The responses from these sources are very similar to those reported here for the questionnaire completed by the second year group.

In their responses to the evaluation questionnaire, the second year students reported that 91% had found the VLE to be beneficial in first year and that the features that were most useful were access to tutorial problem sheets (73%), WebCT mail (45%) and the calendar (36%). Thus, they saw the value of the VLE mainly as a central repository where relevant course material and assessment dates and deadlines could be accessed but also as a means to communicate with academic staff. 79% of the students surveyed found the VLE useful in second year and they found it helpful for accessing past exam papers (86%), and tutorial problem sheets (43%), communicating in small project groups for an assignment using the discussion board (57%) and accessing their grades from some assignments (50%). The VLE is again seen as being effective as a central repository. In addition, having had the opportunity to use the discussion board and grades access features of the VLE in their second year, the

students identified that they valued the aspects which facilitate communication. The responses to the question on which aspects of the second year VLE were most useful are presented in chart format in Figure 2.



The students were asked about what the benefits of using the VLE were and these responses were similar to those just discussed. 50% cited easy access to past exam papers and tutorial problem sheets and 21% said obtaining information on course information and assignments. When asked about disadvantages, 43% said there were none they could think of while 29% mentioned the fact that not all of their lecturers used the VLE. When asked if they would like to see a VLE used more or less in the future, 100% opted for more. The question that followed looked for their input on how a VLE could be used more. 71% of the students surveyed wanted lecture notes to be posted up and 50% wanted to be able to access tutorial problem sheets before the tutorials. It has been the authors' policy not to use the VLE to post up lecture notes for any undergraduate courses except for final year students. They provide copies of the notes (sometimes as gapped handouts) to those who attend each lecture but are of the opinion that providing notes remotely will lead to reduced attendances at lectures and that the students most likely not to attend in these circumstances will be those most in need of the explanations and learning support provided in lectures. Some other lecturers in the School do not supply handouts of their notes and students take them down in lectures.

Evaluations By Other Higher Education Institutions

Evaluation carried out in other colleges have shown that students appreciate the flexibility of VLEs. At Michigan Technological University (Charlesworth and Vician, 2003), WebCT was introduced as a course management tool for first year chemistry in 2000 which hosted course notes, on-line quizzes and exams, e-mail and discussion boards. The use of WebCT as a VLE was introduced to complement other methods of learning and not to replace them. They also identified an improvement in students perceived learning and confidence. 75% of their students said that WebCT helped them enjoy the class more than the traditional chemistry

classes they had before. At the University of Texas – Pan American (Gregorius, 2005) and Sunderland Pharmacy School (Cunningham, 2003) both institutes also reported positive effects as a result of introducing a VLE.

Conclusion

To summarise, we have established the extent to which VLEs are used in our School. The main usage is as a central repository and for programme management. However, applications involving communication and interactivity are being incorporated to some extent. Where these features have been introduced, student response has been positive. The main barriers to extending the use of VLEs were time constraints and the cumbersome nature of the software as well as a need for training of some new staff. In addition, current users have expressed an interest in the provision of training on use of the more interactive applications such as discussion boards and development of simulations and on-line assessment tools.

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