IN BRIEF

- This article discusses the growth of educational material delivered 'online' for use in the dental undergraduate curriculum.
- Web based educational materials have the benefit of enabling students to choose the time, place, and pace of study.
- A web-based curriculum can decrease classroom time and provide self-paced, active learning experiences for students.

Online learning in dentistry: the changes in undergraduate perceptions and attitudes over a four year period

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Objective To assess the changing perceptions and attitudes of undergraduate dental students towards e-learning between 2001-2004. **Design, sample and setting** This was a retrospective analysis of online questionnaire data, collected from four successive cohorts of final year students undertaking an online therapeutics course in a large teaching hospital. **Methods** Students were required to complete a structured and open questionnaire relating to their perceived ICT skills, the course itself, and their perceptions of e-learning. Simple numeric qualitative and qualitative analyses were applied. **Results** Questionnaires were returned by 328 students (98% response rate). Students' perceptions of having advanced ICT skills increased from 5.5% to 14.5%, with home internet access rising from 62.3% to 89.1 % (2001-2004). There was an increase in: ease of access (25.3% to 47.3%), perception of time saving (17.9% to 37.4%), appreciation of combining traditional and e-learning methods (43.8% to 57.4%) and online tutor access (21.9% to 40.7%). Free comments supporting good e-learning experiences rose from 7.2% to 32.7% with poor remarks decreasing (3.1% to 1.9%). **Conclusions** Students' perceptions of their ICT skills has increased, matched by better equipment and greater appreciation of e-learning. A shift towards preference of a blended approach of traditional and e-learning is evident.

INTRODUCTION

The widespread use of the worldwide web (www) has led to the rapid development of virtual learning environments (VLE) for use in undergraduate education.[1,2] Online learning is a recognised method for delivering educational material and has the benefit of enabling students to choose the time, place, and pace of study.[3] Learners access and interact with organised knowledge resources in demand-specific, virtual communities. Singly or in collaborative groups, online learners find solutions to problems or generate new knowledge within the problem solving process.[4] There have been many changes in the accessibility and use of information technology and the majority of undergraduate dental students are now computer literate and are supported within their institutions by a comprehensive information technology infrastructure.[5]

However, the integration of VLEs such as WebCT™ (Web Course Tools) as an adjunct to more traditional educational delivery within dentistry remains limited.[5] The concept is certainly evolving and there have been a number of descriptive reports outlining success in delivery. One such study reported that after experience with computer-based delivery, 80% of students and mentors felt that it should be a mandatory part of the curriculum.[6]

In 2001 King's College London Dental Institute introduced an online Oral Therapeutics course, as an adjunct to the final year BDS syllabus in Oral Diseases. The course was delivered via Campus Edition of WebCT. The goals of the online course were to provide web-based curriculum matrices which delivered high quality and readily accessible material to students during the final 18 months of their undergraduate dental course. As a measure of their achievement students were required to complete four distinct tasks

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including a collaborative project and a case study assignment which counted towards their continuous assessment for the final qualifying examination. The VLE incorporated a number of pedagogical tools and enabled both students and staff to track individual progress in attaining set milestones and key learning objectives.

There is little contemporary literature outlining the attitudes of dental students to alternative methods of educational delivery.[7] This study tracked the access of the participating student cohorts within the online learning course and their perceived ICT skills over a four year period from 2001-2004 and also examined the attitudes each year's cohort had towards the method of delivery, ease of use and overall perception of benefit.

METHOD

The online Therapeutics course was designed to fulfil the Therapeutics teaching requirements outlined in the General Dental Council's *First five years*. It included all the content resources required in a variety of delivery formats from text to web casts of lectures as outlined in the site map (Fig. 1). Four cohorts of year 4/5 students completed the online course which had a required end of course questionnaire. The course and its tasks including the questionnaire were accessed online through the Dental Institute's WebCT server and links were provided for students from both the College's intranet and the internet, for remote access. The VLE was located on a secure server and all users were issued with a unique username and password. This enabled each individual student to be tracked and progress monitored.

A questionnaire was developed consisting of 12 structured questions and one open question which were initially piloted to a small focus group. Ten of the structured questions allowed only one answer and two permitted multiple answers. Each student was required to complete the questionnaire in order to successfully complete the online course. Those not completing the requirements of the course were not awarded a final grade for the course. The participant's contribution to the questionnaire was anonymous, although a list of those who had not completed the task was available to the tutor. The questionnaire was unchanged in format

Table 1 Questionnaire

Question 1				
What is your level of computer expertise?	**2001**	**2002**	**2003**	**2004**
Basic	40.4%	34.4%	31.8%	32.7%
Intermediate	54.1%	50.8%	59.1%	52.7%
Advanced	5.5%	14.8%	9.1%	14.5%
Question 2				
Do you have internet access at home	**2001**	**2002**	**2003**	**2004**
Yes	62.3%	65.6%	81.8%	89.1%
No	37.7%	34.4%	18.2%	10.9%
Question 3				
If you have internet access at home, what is your modem/access speed?	**2001**	**2002**	**2003**	**2004**
28 Kbps	0.9%	0.0%	0.0%	0.0%
33 Kbps	0.0%	6.7%	0.0%	1.9%
56 Kbps	29.0%	44.4%	35.0%	17.0%
ISDN	0.9%	4.4%	8.3%	0.0%
ADSL	1.9%	4.4%	10.0%	30.2%
Other	3.7%	2.2%	1.7%	5.7%
Don't know	63.6%	37.8%	45.0%	45.3%
Question 4				
How easy was it to access the site?	**2001**	**2002**	**2003**	**2004**
Very easy	16.6%	21.3%	13.6%	21.8%
Easy	38.6%	45.9%	50.0%	45.5%
Satisfactory	40.0%	31.1%	27.3%	25.5%
Difficult	4.1%	1.6%	9.1%	7.3%
Very difficult	0.7%	0.0%	0.0%	0.0%
Question 5				
Navigation: How easy was it to find your way around this course?	**2001**	**2002**	**2003**	**2004**
Very easy	2.7%	9.8%	9.1%	9.1%
Easy	25.3%	49.2%	42.4%	47.3%
Satisfactory	51.4%	32.8%	34.8%	32.7%
Difficult	16.4%	8.2%	12.1%	10.9%
Very difficult	4.1%	0.0%	1.5%	0.0%
Question 6				
Which type of teaching method do you prefer?	**2001**	**2002**	**2003**	**2004**
Traditional lectures	55.5%	37.7%	19.7%	38.9%
WebCT	0.7%	3.3%	0.0%	3.7%
Combination	43.8%	59.0%	80.3%	57.4%
Question 9				
Is this online course timesaving for you?	**2001**	**2002**	**2003**	**2004**
Yes	17.9%	26.2%	37.9%	36.4%
No	61.4%	29.5%	28.8%	34.5%
Don't know	20.7%	44.3%	33.3%	29.1%
Question 10				
Would an online course like this help with revision for exams?	**2001**	**2002**	**2003**	**2004**
Yes	42.5%	62.3%	75.8%	46.3%
No	37.0%	14.8%	12.1%	24.1%
Don't know	20.5%	23.0%	12.1%	29.6%

Table 1 Questionnaire

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Question 11				
What do you do if you need help?	**2001**	**2002**	**2003**	**2004**
Email tutor	21.9%	33.3%	47.0%	40.7%
General question to Bulletin Board	8.9%	8.3%	6.1%	5.6%
Go and see tutor	60.3%	51.7%	39.4%	46.3%
Do nothing	8.9%	6.7%	7.6%	7.4%
Question 12				
Overall how helpful has this online classroom been to you?	**2001**	**2002**	**2003**	**2004**
Very helpful	2.1%	3.3%	9.1%	12.7%
Helpful	25.3%	41.0%	51.5%	29.1%
Satisfactory	42.5%	47.5%	31.8%	40.0%
Unhelpful	20.5%	8.2%	3.0%	16.4%
Very unhelpful	9.6%	0.0%	4.5%	1.8%

and content for each year group (2001-2004 inclusively).

Data from each of the year group responses were collated and analysed (Table 1). The multiple answer questions (Q7 and Q8) were omitted from the analysis as they were complex combinations of preferences for types of features within the course, which require deeper examination. Additionally a large number of Bulletin Board messages posted by the students on the online course have been omitted from the analysis and these form the basis of a further study.

RESULTS

Completed questionnaires were received from 328 students with a response rate of 98%. Two hundred and fifty students added open comments to the questionnaire, the themes of which are summarised in Table 2.

DISCUSSION

The goals of this questionnaire were to obtain course feedback, assess the perceived ICT skills of the participants and their attitudes to online educational material as an adjunct to traditional course delivery. Table 1 demonstrates that the majority of final year students at the Dental Institute have a perceived intermediate level of computer expertise, with an increase in advanced level knowledge since 2001. The study showed that there are an increasing number of students who have internet access at home, from 62.3% in 2001 to a marked increase of 89.1% in 2004. This indicates availability and accessibility are increasingly less of a barrier to course delivery outside the educational institute.

There was also an increase in speed of internet service available since 2001. Fewer students are accessing the internet via low capacity dial-up of 56Kbps and there is a demonstrable increase in ASDL modems. The rapid growth of internet for the delivery of information has enabled teaching materials to be placed on websites allowing student access to course material.[8] However, with students becoming more technologically advanced and possessing equipment that enables them to receive data faster, educational content may now be presented interactively and of a high technological standard such as video streaming to create web casts. This increased

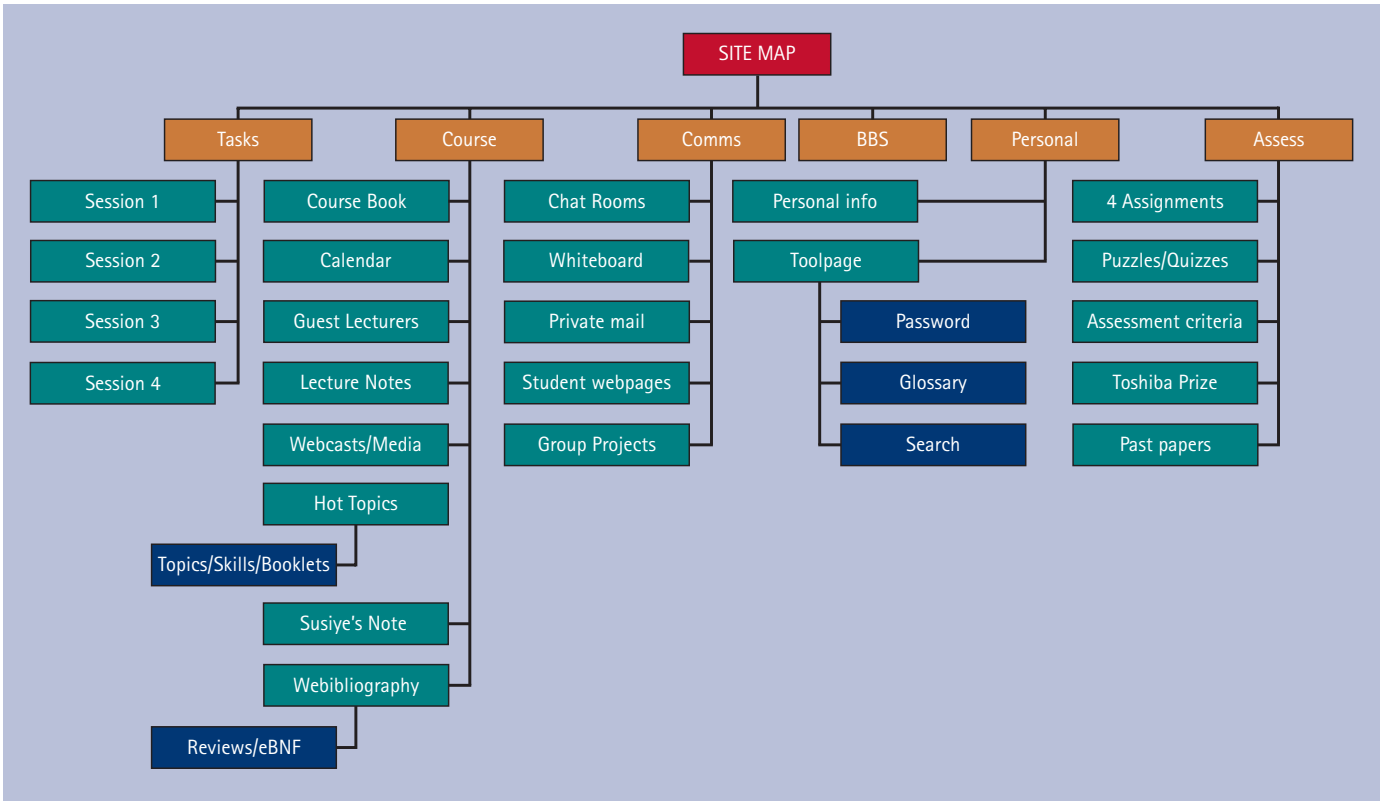

Fig. 1 Site map

Table 2 Themes emerging from the free comments and their percentage reporting

'Please feel free to add your comments here'	2001	2002	2003	2004
Good learning experience	7.2%	11.9%	27.0%	32.7%
Poor learning experience	3.1%	4.8%	1.7%	1.9%
Preference for traditional teaching methods	6.4%	4.8%	3.9%	3.8%
Good access to site especially from home	10.3%	9.5%	6.8%	7.7%
Poor access issues	6.4%	7.1%	1.7%	0%
Navigation difficulties	2.1%	2.4%	3.9%	0%
Course improved computer skills	7.2%	4.7%	6.8%	0%
Greater computer skills needed	7.2%	4.7%	0%	1.9%
Appreciation of e-content	4.1%	7.1%	5.1%	7.7%
Positive response to Bulletin Board messaging	8.2%	7.1%	6.8%	7.7%
Liked collaborative learning	1.0%	0%	5.1%	3.8%
Did not find group working easy	6.4%	4.8%	1.7%	0%
Access to tutor issues	2.1%	0%	5.1%	3.8%
Would like other subjects taught this way	2.1%	4.7%	1.7%	3.8%
Not classified	26.2%	26.4%	22.7%	25.2%

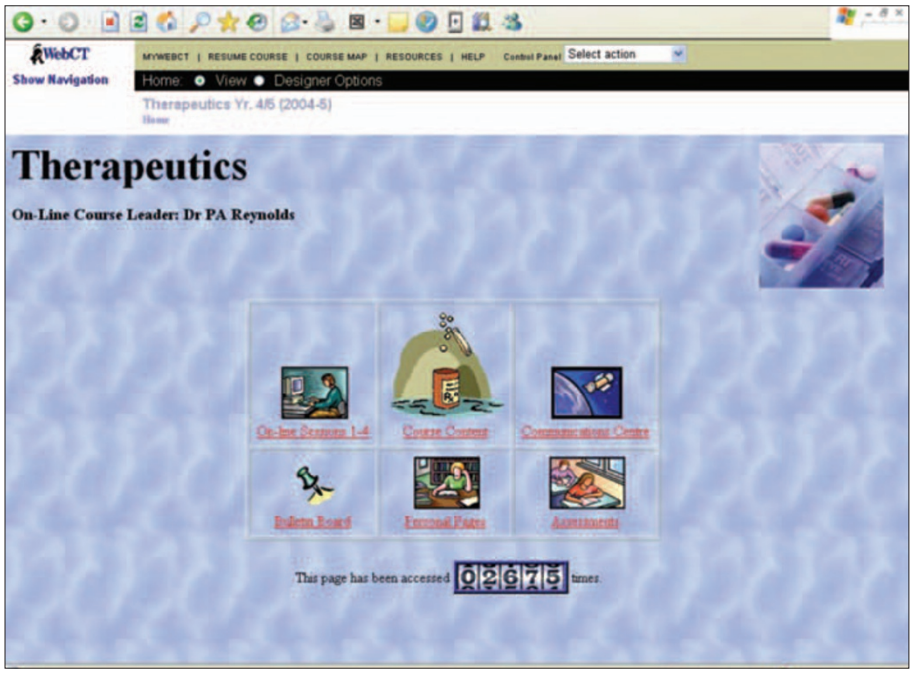

Fig. 2 The online Therapeutics course homepage

capability both personally and technologically facilitates the true delivery of online learning, as opposed to the downloading of notes to support a lecture-based delivery.

Over the four years of the study, the increase in computer familiarity also correlated with an increase in the perceived ease of access to the site (Fig. 2). Each student cohort generally found that the site was easier to access and navigate than the preceding year, with the student numbers who rated site navigation as 'easy' increasing from 25.3 % in 2001 to 47.3% in 2004. Those who rated their experiences as 'difficult' decreased from 16.4 % to 10.9% over the respective period.

When testing preferences to online delivery of dental education, a greater percentage of students preferred lectures to exclusive online access as a method of learning throughout the study period. Indeed, until recently, the culture of teaching and learning within the dental curriculum has been almost wholly traditional and so the students have not yet had motivation or the experience of online learning in higher education. However, over the four year period, the results showed an increasing number of students who would opt for a combination of lecture based delivery supported by online learning as the primary method of teaching (43.8% in 2001 to 57.4% in 2004).

The results showed that as adaptation to and proficiency in the use of ICT increased with each cohort, the number of students who found the online course timesaving also increased (36.4% in 2004 compared to 17.3% in 2001). This is significant as there is likely to be greater uptake and use of learning resources which have perceived benefit. Perhaps unsurprisingly, the results also showed that the majority of each student cohort across the four year study period felt that an online course such as the one provided would help in revision for exams. This is particularly relevant as students often have vastly different approaches to exam preparation and online resources enable the individual to chose the time, location and pace of study to suit their particular needs.

The results also display trends useful for academic workforce planning. With the expansion in undergraduate student numbers and the relative decrease in academic staff levels there are many moves to establish areas where alternative strategies may be employed to make the most effective use of student contact time. There are demonstrable time savings in provision of online learning and this study showed that with the introduction of an online course fewer students would need to consult their tutor (60.2% in 2001 to 46.3% in 2004). Across the cohorts there is an increasing trend to use email as a primary way of contacting staff members directly regarding problems (21.9% to 40.7% over the respective period).

Overall, it has been shown that the WebCT online Therapeutics course was well accepted by the students and each year group has had a majority of users rate the course as satisfactory or better. This study supports other studies which demonstrated that web-based courseware

was felt to be a useful additional resource for students.[8] Free comments further substantiate this with an overall positive learning experience expressed in the free text by 7.2% in 2001 increasing to 32.7% by 2004. Conversely a poor experience was noted by 3.1% and this decreased to 1.9%, a clear indication of the cultural shift towards e-learning.

CONCLUSIONS

This study has outlined final year dental student experiences following the introduction of an online course. It has established that undergraduate dental students are becoming increasingly technologically aware and have access to more advanced hardware. Thus, students are able to remotely access data and information at the time of their choosing. A web-based curriculum can decrease classroom time and provide self-paced, active learning experiences for students. However, clear needs and specific aims and goals are needed to ensure success as students often have very little motivation to partake in activities that could be provided by a single textbook.[9]

The increase in availability of high speed internet access, both at home and within the university, allows for the provision of more advanced and ambitious programming. However, this must be supported by the assessment and provision of ICT training to students and staff with respect to the use of computers and related digital technologies and educational software programmes.[10] By consistently employing principles of effective learning, educators will unlock the full potential of web-based medical education.[11,12] At this early stage of implementation of e-learning to the undergraduate dental curriculum, a blended approach of traditional and web-based delivery is preferred. In part, this combination may cater for a wider range of learning styles but may also be the key for enhancing clinical training with web-based support in the future.

The overall results of this study demonstrate that the online course is increasingly being appreciated by the vast majority of final year students over a four year period.

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