The development and evaluation of the use of a virtual learning environment (Blackboard 5) to support the learning of pre-qualifying nursing students undertaking a human anatomy and physiology module

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Summary Students commence nurse education with varying levels of understanding of human anatomy and physiology due to a wide range of previous exposure to the topic. All students, however, are required to attain a broad knowledge of this topic prior to qualification.

This paper describes the use of a Virtual Learning Environment (VLE), Blackboard 5, and the associated development of appropriate resources aimed at supporting nursing students undertaking a human anatomy and physiology module at Higher Education Level 1. The VLE was used as part of a blended learning approach.

The results suggested that the majority of students utilised the VLE throughout the academic year. Opportunities for independent and self-directed learning were available in that students chose when and where to learn. Students generally commented favourably on ease of use and type of resources available. Frequency of use of the VLE, however, did not correlate strongly with the final examination mark achieved.

Overall the VLE and the associated available resources appeared useful in supporting student learning and has been adopted for use in subsequent years.

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Introduction

Students are admitted to pre-qualifying nursing programmes with a varying knowledge base concerning human anatomy and physiology and therefore, their learning needs concerning this topic can be very diverse. In addition to a wide range of learning needs within the student group, cohorts of students are often large (400 or more) which can limit the ability of lecturers to provide appropriate individual learning support. Gresty and Cotton (2003, 340) suggest that ‘the teaching of biosciences in the nursing curriculum has long been identified as a problem and a source of anxiety by teachers, students, and even practicing nurses’ Computer-assisted learning (CAL) could provide a means by which students could study human anatomy and physiology more effectively since, according to Kenny (2002, 128) ‘Over the last decade it has been argued that CAL assisted learning provides consistency of educational delivery, reduces instruction time, enhances effectiveness and mastery of learning, improves retention and increases student motivation, satisfaction and enjoyment in learning.’

A VLE is a computer software package which supports a wide range of presentational and communication functions. Blackboard is a leading example of a VLE which many Universities have chosen as their e-learning platform (Blackboard, 2004). Within VLEs lecturers can set up and maintain areas dedicated to specific modules, and content accessed by students can be prepared within familiar software applications such as MS Word and PowerPoint. Lecturers may also monitor student progress through resource usage and assessment statistics.

VLEs have been reported effectively to support learning of large groups of students both within (de Lange et al., 2003) and across institutions (Jeffries et al., 2003). It is important for educators to proceed with e-learning innovations on the basis of sound pedagogical underpinnings (Adams, 2004), as it has been suggested that there is a danger in letting technology override pedagogical aims (Billings et al., 2001; Brabazon, 2002). However, it should be noted that pedagogical challenges presented by the development of VLEs are not unique and have been around in higher education for some time (Fetherston, 2001; Twomey, 2004).

The use of VLEs by lecturers delivering modules to healthcare students has been reported (Burrows et al., 2003; Cader and McGovern, 2003; Hayward, 2003; Neville, 2003). In terms of nurse education several recent studies have focused on the use of VLEs in post-qualifying education (Atack and Rankin, 2002; Sit et al., 2005; Huckstadt and Hayes, 2005). In the context of pre-qualifying education, Kenny (2002) evaluated the introduction of a Health Informatics module which used a VLE, whilst Gresty and Cotton (2003) have reported on the development of a pre-course biology-based open learning resource (Headstart). However, there is a paucity of literature examining the use of VLEs to support the delivery of anatomy and physiology modules to nursing students. As de Lange et al. (2003) highlight, the impact of new technologies on learning outcomes should be evaluated. This paper aims to describe the use and evaluation of the use of a VLE (Blackboard 5) to support the learning of student nurses undertaking a 20 credit human anatomy and physiology module at Higher Education Level 1 run over two semesters.

Methods

VLE site design

The VLE used was Blackboard 5. Following timetabled IT induction sessions, first year nursing students were enabled to access a site within the VLE which contained learning resources designed to facilitate the student to achieve the modular outcomes of a module on human anatomy and physiology. The site was available throughout the academic year 2001/2002. The VLE was used as part of a blended learning approach.

The human anatomy and physiology module was a 20 credit module, at Higher Education Level 1, taught in a one year common foundation programme. The module considered the normal anatomy and physiology of 12 biological systems and also introduced the topic of pharmacology (see Table 1).

Resources to enable the student to achieve the required modular outcomes were developed with the aim of:

- increasing the flexibility of learning in terms of enabling students to chose where and when they engaged in learning;
- providing ongoing, self-directed formative assessment;
- developing the use of e-learning as a teaching strategy to complement lecture delivery.

The design of the site was carefully considered to try to address a range of different learning styles. Sit et al. (2005) found recently in their use
of a VLE to support post-qualifying nurses that students valued the opportunity to physically meet with their study group peers and recommend ‘a blended approach including online learning and supplementary on-site classroom meetings’ (2005, 146). Thus, although an important element of the module was to provide individualised learning routes there was a positive attempt to avoid isolating learners. Many aspects of the design of the module, therefore, emphasised opportunities to bring students together either physically or virtually, including the use of lectures, revision tutorials and on line discussion, This approach is clearly informed by the constructivist perspective which has been developed from the work of Vygotsky (1978) where the promotion of interaction between students engaged in learning tasks is seen as a pre-cursor to further understanding.

Within the VLE site for the module each biological system was considered within a separate section which included a brief overview of the system and relevance of normal functioning to nursing practice and then detailed a range of learning resources. These included reference to the appropriate page numbers for the system in the key texts, lecture notes, directed learning sessions (DLSs) and formative multiple choice questions (MCQ) relevant to the system. The biological systems were taught sequentially and resources for each system appeared on Blackboard as the system was addressed in the lecture timetable. This was to enable linkage of the lecture content with the learning resources available, without overwhelming the student with a whole range of new information.

Twelve sessions were delivered as DLSs instead of a more traditional lecture format. Kolb’s (1984) theory suggested that experiential learning takes place in four phases: this informed the design of the DLSs. For example; the session on the neurological system asked students to experience a dissection of the human brain (by watching a streamed video) and then to draw a labelled-diagram of certain structures. Finally students were asked to write a short summary of the structure and function of elements of the nervous system and describe why they thought it important to study this. This approach endeavoured to provide opportunities for reflection, conceptualisation and experimentation.

The DLSs took several formats:

- reading from text with interspersed questions and comments;
- links to a Web page and reading from text with interspersed questions and comments;
- streamed video sections with interspersed questions and comments (Green et al., 2003).

The answers to questions posed in the DLS were placed on Blackboard as a separate item a few days following the placement of the DLS to enable students to self assess their responses.

Notes of each lecture were placed in the appropriate biological systems section several days prior to the lecture where possible. It was considered this would allow students to familiarise themselves with the topic of the forthcoming lecture, provide a framework for lecture notes taken in the lecture and outline the lecture content should the student miss the lecture. All lecture notes followed the same format and were checked and put on the Blackboard by the module leader. The notes consisted of the wording used on the PowerPoint slides for the lecture and, if a diagram used in the lecture could not be reproduced, reference to an appropriate diagram in the recommended text. Lecture notes were presented in a Word document on as few sides of A4 as possible, as printing PowerPoint slides can be costly for students (Cader and McGovern, 2003).

To provide students the opportunity to identify their knowledge strengths and weaknesses and to enable them to become familiar with the examination format (an MCQ paper), MCQ related to the learning aims and outcomes of each biological system were available in each system section. The number of questions for each system ranged from 5 to 20 (mean 15). Explanations and associated reading in one of the recommended texts were shown when the answer was given once the student had completed the MCQ. In semester 1 the MCQs were set up to allow the student only one attempt

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<th>Table 1</th>
<th>The biological systems and the sequence in which they were taught</th>
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<td>The immune system</td>
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<td>The respiratory system</td>
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<td>The musculoskeletal and integumentary</td>
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<td>The gastrointestinal tract and liver (includes basic nutrition)</td>
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<td>The reproductive system and continuity (includes genetics)</td>
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as it was considered that this would mimic the examination scenario closely. However, following student requests multiple attempts were allowed in semester 2.

A range of other resources were also available in addition to the sections for each system. These included a 32 item MCQ ("test your knowledge quiz"), external links, staff information, periodic announcements and a discussion board. The 32 item MCQ was available in semester 1 and aimed to encourage students to examine their knowledge of basic science, introduce some basic scientific terms, and encourage those with little prior knowledge of science to study using an appropriate text at the start of the module. Biographical details of the lecturers teaching on the module were shown under the staff information section with the aim of enabling students to become more familiar with lecturers.

The discussion board aspect was developed in December 2001 in response to increasing numbers of emails received by lecturers requesting support with learning. A discussion board was set up for each system, for technical queries and for assessment issues. An anonymous postings discussion board was set up at Easter 2002 for those students who wished to ask questions anonymously.

Data collection and analysis

Descriptive statistics concerning usage by all students registered for the module of the VLE module site were analysed \((n = 652)\). The level of usage of the site was measured in terms of number of page requests, i.e., the number of times a page was entered. It should be noted that this does not indicate the student read the page just that they accessed it. The number of students registered for Blackboard 5 made analysis complex. The course site was reset on March 1st 2002 as the maximum number of page hits Blackboard 5 can record was nearly reached. Some data was not recorded for a few days in March due to a technical error. This is unlikely to impact significantly on the overall access figures as the students were at the end of their clinical placement and therefore focussed on their clinical practice at that time. Data was imported into Excel and SPSS from Blackboard 5. Pearson product moment-correlation was used to correlate number of pages accessed with the final examination result (i.e., percentage achieved). The data for 633 students registered on Blackboard who sat the first sitting of the examination in May 2002 was included in this analysis.

The module was evaluated following the final lecture. Student learning groups were stratified according to site of clinical practice (one of five sites), selected randomly and then students within the group were requested to complete a paper copy of a module evaluation questionnaire in May 2002. Seventy-four students registered on the module completed the questionnaire anonymously. This provided both quantitative and qualitative data. The module evaluation questionnaire was a slightly amended version of the standard university module evaluation questionnaire. A module evaluation questionnaire is issued to a number of students on completion of the module as part of normal University practice. The questionnaire required responses to 18 statements concerning the module content and organisation, and teaching, learning and assessment aspects. Students were asked to indicate their response to each statement on a 5 point Likert scale, with the descriptor for 1 being very poor/very little and for 5 being very good/very much. Responses to the statements "Prior knowledge assumed", "Amount of material", "Availability of course materials", "Did you find having lecture notes of Blackboard prior to lecture useful", "Did you find the lecture notes on Blackboard useful", "Overall, how would you rate the learning experience?" and "Overall, how would you rate this module?" are reported here. Descriptive statistics were used to describe the data obtained. At the end of the questionnaire students were invited to write comments under the headings "What aspects of the module do you feel have been most helpful and why?" and "What aspects of the module do you feel have been least helpful and why?"

The results of the summative examination are presented in terms of percentage passed. Student who achieved a pass were deemed to have achieved the modular learning outcomes.

Results

Student usage of VLE

Fig. 1 illustrates the general pattern of page access from module commencement to the day before the examination. Two peaks of usage can be seen one in October 2001 and one in May 2002.

Fig. 2 shows page access by day of the week. As can be seen usage peaked on Tuesdays, with a steady decline over the rest of the week.

Fig. 3 shows the usage by hour of the day. As can be seen usage peaked between 10.00 and 14.00 h. However, students can be seen to access the resources available at all times.
Frequency of individual student usage of VLE

Pages within the BlackBoard site were accessed a total of 152,749 times over the time period 01/10/01 to 26/05/02. The frequency with which students accessed the pages was variable and ranged from twice to 1131 times. There was a weak positive correlation between number of pages accessed by a student and their final examination mark \( (r = 0.3, p < 0.01) \).

Use of discussion boards on VLE

The discussion boards were not used extensively. Up to 26/05/02 28 entries on the discussion board entitled "technical queries" were made, but some entries related to another module. Nine entries were made to the discussion board on assessment issues and zero to 17 on each of the discussion boards for the systems. The discussion board inviting anonymous postings received only 6 entries. On the module evaluation questionnaire one student...
commented that he/she found the discussion board "a fantastic method of help and communication".

**Formative MCQs on VLE**

Thirteen MCQs were available and most students registered on the module undertook one or more. Recorded use from 27/03/02 ranged from 352 students completing the MCQ within the pharmacology section to 484 completing the MCQ within the section containing learning resources related to the cell. Eight students commented on the module evaluation questionnaire that they found the MCQs useful and one student requested more MCQs were made available.

**Module evaluation**

The University module evaluation questionnaire (n = 74) suggested that the majority of students were satisfied with the level of prior knowledge assumed (53% scored three) and amount of material covered (71% scored three or four). Students reported that they found course materials readily available (54% scored five), and found it useful to have the lecture notes on Blackboard prior to the lecture (73% scored five). The quality of the lecture notes on Blackboard was considered high (65% scored five). When asked "overall, how would you rate the learning experience?" 79% of students rated the learning experience highly (four or five) and when asked "overall, how would you rate this module?" 62% rated the module highly (4 or 5).

Twenty one students commented that they found access to lecture notes before lectures useful, for example, one student stated "notes on Blackboard very useful as they give you a foundation to further your study and also good for revision". Two students commented that they found the notes and quizzes on Blackboard useful. Nine students stated that they found the VLE useful or helpful as a learning tool. Only one student commented that he/she did not like using Blackboard.

Seven students commented favourably on the DLSs. Two students, however, suggested that there was too much emphasis on self-directed study.

**Summative assessment**

The summative examination for the module consisted of a multiple choice questionnaire. A good pass rate was achieved for the examination.

**Discussion**

Students enter pre-qualifying nursing programmes with a wide range of educational experience in the study of human anatomy and physiology. The wide range of learning strategies was designed to address a variety of learning styles in order to meet all students’ needs. Students chose to use the resources available in varying ways and to varying degrees, for example, some students appeared to enjoy the DLSs and some did not appear to use them.

The VLE was utilised by the majority of students. There were peaks of usage which coincided with particular events. The peak of usage seen in October could be attributed to the compulsory IT Induction session students undertook where the students were required to create their Blackboard 5 account, and then explore Blackboard. The examination date was May 2002 and the revision period accounts for the second peak of usage.

Although students were heavily encouraged to use the VLE, the module used two key texts to help students achieve the learning outcomes of the module. Some students used the VLE minimally and verbally reported that they preferred to study from text books. It is appropriate that students are able to utilise a range of teaching strategies in order to best address their learning style. However it is suggested the use of VLEs may help students who are unfamiliar with computer packages to develop their key skills (Department for Education and Skills, 2005); particularly those of information technology and information literacy (Huckstadt and Hayes, 2005; Atack and Rankin, 2002).

The issue of staff resources to prepare material for the VLE and to support the running of the VLE has to be considered. The development of the resources was labour intensive. In addition technical difficulties had to be dealt with promptly to ensure students had the resources available to them as required. Whilst it has been suggested that use of Blackboard by students and lecturers does not require a high level of IT expertise (Cader and McGovern, 2003) it must be recognised that the use of a VLE to support student learning is only practical where infrastructure to support such a programme is available. Dissatisfaction can arise if infrastructure fails (Hayward, 2003).

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Students reported that they liked having lecture notes available prior to the lecture. Lecture note availability has been reported to be particularly useful for students with learning difficulties (Cader and McGovern, 2003). Indeed, guidelines issued by
the Accessibility in Learning Environments and Related Technologies Project (ALERT, 2005) specifically recommend this. Students were required to print out their own lecture notes which reduced the time spent photocopying and distributing handouts by lecturers prior to a lecture, but did have cost implications for students. de Lange et al. (2003) suggested that the provision of study materials via a VLE enhanced accounting students’ perception of their learning. The availability of lecture notes online was found to be one of the factors associated with improved student motivation (de Lange et al., 2003).

One of the disadvantages of Blackboard has been suggested to be that students may access notes on Blackboard rather than attend lectures (Cader and McGovern, 2003). Attendance at lectures for the module appeared good to the lecturers, and did not seem affected by the presence of lecture notes on Blackboard. Many students attended the lectures having printed out a copy of the lecture notes. However, if students were unable to attend a lecture, the notes provided a framework for self study.

The summative examination suggested most students had met the required learning outcomes evidenced by achievement of a pass. The pass rate was considered satisfactory given the wide range of prior knowledge of human anatomy and physiology.

Students commencing this module had diverse educational backgrounds and therefore had to interpret their own needs and use the available learning resources accordingly. There is much in common between the skills involved in this approach and those described by Biggs (1999) in his analysis of self-directed teaching and learning activities as metacognitive learning skills. It is hoped that the skills practised in this approach to learning could support further independent learning by students throughout their pre-qualifying programme and in study following qualification. The blended approach outlined here was based on a variety of pedagogical approaches, and by presenting information to students in a variety of ways it is suggested that a greater number of individual learning styles could be covered (Adams, 2004; Mogyey, 1999).

The VLE has been used successfully in successive years following this report and the percentage of students passing the summative examination has increased. Though this may not be related to the use of the VLE, students are certainly able to access learning resources that enable them to meet the modular outcomes more easily than before the VLE was used.

Conclusion

The use of a VLE (Blackboard 5) supported the learning of student nurses undertaking a human anatomy and physiology module at Higher Education Level 1. The resources available on the VLE appeared to contribute to a good overall learning experience for the students. However, using a VLE to support learning does require lecturer time and technical support.

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References


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