ORIGINAL ARTICLE

Developing a virtual learning course in emergency medicine for F2 doctors

Simon Carley, Kevin Mackway-Jones

See end of article for authors' affiliations

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Correspondence to:
Simon Carley, Emergency
Department, Manchester
Royal Infirmary, Oxford
Road, Manchester M13
9WL, UK; simon.carley@mmc.nhs.uk

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Changes in the regulation of junior doctors' hours and in the design of medical career pathways have rendered the traditional weekly tutorial ineffective for teaching the core knowledge of emergency medicine. In this paper, the inception of a virtual learning environment and the development of an online course for F2 doctors in our emergency department are described. The course, delivered in the open source Moodle virtual learning environment, allows us to reliably deliver educational content to all our juniors regardless of shift patterns. It provides insight into the effectiveness of that education, and records the students' activities and achievements to a level far beyond that achievable through traditional teaching methods.

Recent changes in postgraduate medical training have presented many challenges to emergency departments.¹ There is now a greater emphasis on the need to define that the teaching is delivered against national criteria and to provide documentary evidence that this teaching has occurred. This is a challenge in itself, but is further compounded by changes in working hours,² the unremitting 24-h pressures of emergency care and the modernisation of medical careers.¹

Like many emergency departments, we have prided ourselves on delivering a high-quality teaching programme for many years. However, it has become apparent that the degree of engagement of our junior doctors with the teaching programme has decreased. In 2005, attendance at teaching had fallen to approximately 30% of eligible doctors per week. In large part, this was due to shift patterns, holidays and study leave, and on occasion to the business of the department during teaching times. Our juniors failed, therefore, to access 70% of our well-designed, well-taught, teaching programme, thus rendering it ineffective. The teachers were disheartened by this clear failing and they themselves became less committed. A new and radical approach was required.

We surmise that similar problems exist in other emergency departments in the UK and elsewhere. We describe the selection, design and implementation of a web-based virtual learning environment designed to deal with the problems of access to, supervision of and documentation of learning among junior emergency department doctors.

WHY A VIRTUAL LEARNING SYSTEM?

A virtual learning environment (VLE) allows students to access and interact with teaching materials irrespective of time or place.³ It requires access to the internet; this is more flexible than traditional methods, as students can engage from a variety of locations including home. Such flexibility allows students to interact with the teaching materials regardless of what shift they are on, and (to some extent) at a time that suits them.

In the past, we have tried to select the most "important" areas of teaching and to deliver them in the initial weeks of any course. Inevitably, however good the topic selection, the juniors come across patients whose conditions are covered later. There is no way they can bring the teaching forward. In contrast with this, VLEs allow access to all the teaching materials all the time and, although the course may be arranged in traditional weekly

topics, open access means that the juniors can look at materials early if they have a particular learning need.

SELECTION OF VLE SYSTEMS

The VLE system is essentially the software that enables the course directors to organise and deliver the educational content online. A number of VLE systems are available. In the academic community, the most commonly used systems are WebCT and Blackboard (which have recently merged) and Moodle (<http://www.moodle.org>). A detailed description of the available software is beyond the scope of this article. It is sufficient to say that all systems have pros and cons, some features are available only in particular systems, but all can deliver basic content to the web and all have a solid academic background. We selected Moodle primarily because it is open source, is widely used in the academic community (including large organisations, such as the Open University) and is free to download and use (fig 1). The features of Moodle can be seen at <http://www.moodle.org>. Alternatively, you can access the "Getting to know Moodle" course at <http://classroom.stemlynz.org.uk> for a hands-on trip into our virtual classroom.

KEY FEATURES OF VLE SYSTEMS

VLE systems can function in a variety of ways, but are essentially course management systems that allow the tutors to guide students through teaching material. Perhaps the most important difference between a VLE and a simple departmental website is the way in which interaction is a feature.⁴ Material can be delivered in a variety of ways.

Information delivery

Clearly, one purpose of the system is to deliver "content" to the students. The great temptation is to simply transfer documents and presentations on to the web, and expect the students to work through them. Such "brain dumping" is likely to be ineffective—effective web-based learning requires a different way of setting out materials. This can be achieved in a number of different ways:

- Original content can be created online by the tutors. This is time consuming and largely unnecessary. There is little to be gained from writing a textbook of emergency medicine

Abbreviation: VLE, virtual learning environment

Figure 1 Screenshot of Moodle courses on St Emlyn's.

online, as many exist already. However, it may be necessary to create content at a local level to describe local guidelines and policies.

- Documents can be uploaded to the web server as separate files linked to the main teaching page. This is useful for documents such as departmental guidelines and policies.
- Content can be delivered as links to other websites. This is especially useful as it avoids the need to reproduce information that is already in the public domain. Students can be directed to a website that contains relevant information. This is especially useful when the content may change on a regular basis—examples include links to the Health Protection Agency or World Health Organization for the most current material about infectious diseases. A variety of clinical cases are also needed. We source these from the St Emlyn's virtual hospital (<http://www.stemlyn.org>). This is our free-to-access virtual hospital with a wide range of virtual patients that can be used for teaching purposes.
- Multimedia files can be added to the VLE (pictures, video, sound). These are useful if practical procedures need to be shown or if the content, such as interactive anatomy pages, need to be displayed. In fact, any content that is available on the web can be linked out from the site.

Activities

A concern with all web-based learning is determining how students are interacting with the material. Simply placing content on the web means nothing unless the interactivity that occurs in face-to-face teaching can be reproduced. It is important to design the online activities with the aim of guiding trainees to a deep approach to the learning material. This can be achieved through activities such as case-based discussions and interactive lessons. Typical VLE system features that allow this include:

- *Discussion:* This can be asynchronous (the bulletin board or forum) or synchronous (the chat room).⁵ We predominantly use asynchronous communication, as the advantages of such a system (access at the time of the student's choosing) are a

principle reason for adopting the VLE. We also use a chat room once a week to allow students to contact their tutors. Discussion⁶ is a powerful tool, and we use this to facilitate a reflective approach to learning. Typically, a group is asked to discuss a clinical case and to use their peers and tutor to identify learning needs and subsequently to answer them.

- *Lessons:* It is possible to create online lessons for students that work as a series of interactive pages. Each page is separated by a question that students must answer to progress to the next page. Feedback can be given for correct or incorrect answers. These are especially useful for topics such as x ray interpretation or the assessment of laboratory results.
- *Quizzes:* Quizzes can be used to allow students to assess the validity of their own learning. For instance, a brief quiz can be placed after a reading assignment to allow the student to judge whether they have assimilated and understood the content in context. Such quizzes can be set up to allow students to have multiple attempts (and can also be designed to shuffle questions and answers to ensure that any improvement reflects better understanding rather than better test taking).

Assessment

In traditional teaching methods such as tutorials, there is an emphasis on delivering information, but usually no measure of whether the information has been assimilated or understood. Although it is possible to observe clinical practice while working, it is rare that we see enough of a trainee to determine how much knowledge has been gained. VLEs offer a number of ways to assess students.

- *Lessons:* A structured lesson in the VLE can be set up to keep a score as each item of information is tackled and questioned. These are usually used as running scores for the students (to see how they are getting on), but may also be of value to the tutors in identifying strengths and weaknesses in knowledge.

- *Quizzes*: These can be set using a variety of question types. As noted above, they can be used as a formative tool by students to see how they are progressing, or by tutors as summative assessments at the end of a topic or course.
- *Assignments*: Most VLEs allow a drop-box function where students can upload projects for grading. These may be short web-based submissions or a file upload that is especially useful for longer pieces of work (eg, submitting an audit project).

Monitoring

Monitoring student activity is a key feature of VLEs and is incredibly valuable. The degree of information available is substantial and allows the tutors a real insight into the activities and success of the students on the course. Information available includes:

- Time and duration of access.
- Exact (page-by-page) reports of what items were accessed, how often and for how long (eg, how long a lesson took to complete).
- Marks from any quiz, lesson or other activity. The number of attempts, which questions were correct/incorrect, etc.
- Individual posts to forums/discussions/chats, etc.
- Internet protocol address of computer.

This information can be fed back to the students' individual educational supervisors allowing them to determine if they are engaged with the teaching and also to identify gaps or strengths in knowledge. This information can also be used to inform individual learning plans.

PRACTICAL IMPLEMENTATION

A number of practical points need to be considered if you are to adopt a VLE.

Equipment and information technology

A certain degree of knowledge in information technology is required to upload and manage the VLE software. You must have access to a server and have sufficient storage to manage the program and subsequent content. There are costs inherent in this, although it may be possible in some trusts to reduce these by using the hospital's information technology department. The students and tutors require access to a computer, and although it is rare for junior doctors not to have their own computers, this cannot be assumed; thus, access within the hospital and department is essential.

Training the trainers

Having established the chosen system, it is the responsibility of the tutors to develop and upload content. Although this seems relatively straightforward, we thought that they would benefit from appropriate training and sent our tutors to a 2-day course on course design (How to Moodle),⁷ which rapidly brought the team up to speed. We believe that this saved a great deal of time in the long term.

The time required to design, write and upload any course is considerable and should not be underestimated. Our experience suggests that it takes 10–20 times as long as the lesson length—thus, a 1–2 h lesson might take two working days to prepare. However, any time spent is a good investment as, once online, the material can be used repeatedly for subsequent cohorts of doctors on the same course. There is no reason at all why foundation schools or emergency medicine schools locally or nationally cannot use the same online material, and if this happens then eventual time savings will be even more worthwhile.

Time for trainees

It is essential that trainees are given an allocated time in which to access the teaching material. We have allocated "VLE" time on the junior doctors rota; this involves them leaving the shop floor to access the VLE during their shift. In this way, we ensure that they have specific, paid time to engage with the teaching and that we do not rely on them doing the work elsewhere. This also means that there is a clear requirement for them to engage with the material and no real excuse not to complete the activities on time. The service benefits of not having all the junior doctors on duty leave the department at the same time are obvious.

Running the course

We allocate two consultants per cohort of doctors to oversee the virtual learning of that cohort. These VLE tutors are responsible for marking assignments (online), moderating asynchronous forums and running the weekly synchronous student support chat room. In addition to the VLE tutors, each student has their own individual educational supervisor. Cohorts of trainees are divided into discrete groups on the VLE (reflecting the time they start in the department), thus allowing multiple independent groups to be working on the same course at the same time.

Course management

The VLE allows control over when and how the students interact with the material. It is possible to hide elements from students (although we do not advocate this) and drip feed content. It is also possible to allow all information to be available, but to set a program that forces students to engage with a particular topic in a given time period. This is the approach we have taken, and our students are directed to a particular weekly topic. During that week, they are expected to complete the activities specific to that particular topic.

INTEGRATION WITH OTHER TEACHING MODALITIES

VLEs are not a complete panacea to teaching, and care must be taken to consider other aspects of education that cannot be delivered via the web. For example, practical skills, history taking, attitudes and interpersonal relationships are best taught at the bedside with a skilled tutor. However, we believe that such activities are facilitated by the VLE, as face-to-face education time can then be focused on activities that truly require personal interaction. As is the case for all foundation trainees, our junior doctors are also engaged in case-based discussion, practical skill-competency assessments and 360° appraisals. They also undertake audits and have a full programme of face-to-face induction both to the department and to the skills they will require in the specialty. We do not, however, provide any further group-based face-to-face training once induction is finished for this group.

MEASURING AGAINST F2 COMPETENCIES

The VLE system has allowed us to map F2 competencies against the teaching programme. This allows our students to obtain evidence of satisfactory completion of the knowledge associated with those competencies.

Students who engage with the online learning, provide online feedback and who complete 80% of online activities are awarded a certificate at the end of their attachment for inclusion in their personal development portfolio.

SUMMARY

The changes in medical career structure and working hours mean that traditional methods of weekly face-to-face tutorials

are unworkable and do not deliver adequate levels of training to staff. Radical changes in curriculum delivery are required if we are to satisfy these demands. Our experience in developing and delivering a VLE course for F2 doctors has convinced us that it is the future of medical education in the emergency department. If you want to know more, feel free to visit one of the following links:

- Moodle: <http://www.moodle.org>
- St Emlyn's virtual hospital: <http://www.stemlyn.org.uk>
- St Emlyn's Moodle classroom: <http://classroom.stemlyn.org.uk>

Most courses on the St Emlyn's site require a password to enter, but you can view the "Getting to know Moodle" course which will illustrate key features of the system.

Authors' affiliations

Simon Carley, Kevin Mackway-Jones, Emergency Department, Manchester Royal Infirmary, Manchester, UK

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Webcast: International Forum on Quality and Safety in Health Care

Plenary sessions at this year's International Forum on Quality and Safety in Health Care were filmed and broadcast live over the internet. The sessions are still available to view free, on demand and at your own convenience at <http://barcelona.bmj.com>. Each session is accompanied by a panel discussion.

The webcast includes the following, in either English or Spanish translation:

- **Donald M Berwick**: Can health care ever be safe?
- **Richard Smith**: What the quality movement can learn from other social movements
- **Lucian Leape and Linda Kenney**: When things go wrong: communicating about adverse events
- **John Prooi and Harry Molendijk**: Partnering for patient safety