Delivering Multimedia Education in Clinical Biochemistry

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E-Learning

Electronic or e-learning is now an established method of learning and is a development of computer based learning that appeared in the 1980's. It usually takes the form of interactive educational material presented in an electronic medium. It can take the form of Computer based learning, Web based learning, Virtual Classrooms, Digital Collaboration. The delivery of the educational content can be via a number of electronic means. These include distribution via Internet, Intranet / extranet, audio / video tape, CD-ROM, satellite broadcast / interactive TV or email.

There are a number of benefits to the e-learning approach when compared to the traditional didactic teaching methods. E-learning allows instructional consistency to be maintained whilst allowing multiple accesses. Access may be asynchronous and allows the learner to guide their own learning, often non-sequentially[1]. In addition a key feature of many e-learning systems is the capability of providing personalised feedback which allows learners to tailor their learning experience and feel more empowered. Careful structuring of the educational material can result in highly retainable "nuggets" of information being presented to the learner, resulting in a more effective learning process and reduced learning times[2]. E-learning fosters interaction among students and instructors and students learn more when they collaborate with others[3]. Finally, cognitive load theory predicts that a multimedia-based instructional format leads to a better acquisition of complex subject matter when compared with a purely visual instructional format[4].

There are also potential disadvantages associated with e-learning, the most notable of which is that systems can rely heavily on computer technology that can present a natural barrier to use before learning can take place [5]. In additional acquisition of the technology required to take part in e-learning can also hinder uptake. Obviously the technology employed plays a key role in the development of e-learning systems. On the other hand, these resources have become ubiquitous in the developed world.

These advantages and disadvantages should be taken into account to maximise the efficiency of delivering e-learning. The simple copying of material from one learning environment is unlikely to be effective[6]. Although there is potential for learning

materials to be provided at reduced cost, set up costs can be high in terms of personnel time and equipment costs.

Instructional Design for Online Learning

There are a number of design factors that need to be taken into account when creating online learning materials.

- Employ a high level of interactivity to keep students engaged

- Use multiple instructional methods to improve results

- Make the product usable

- Provide ongoing assessment and feedback to reinforce learning

- Use the technology (audio, video etc) to support different learning styles and optimize memory and brain utilization

- Limit use of text

- Let learners guide their own instruction

- Provide scaffolding to allow learners to fill in gaps of learning through help systems etc

In general it is difficult to translate and repurpose traditional learning materials into the online environment when these have been designed for a different learning environment. As a consequence, it can be difficult to achieve some of the design parameters described above.

Cases

One of the earliest online training tools for studying cases in pathology is the HJELM - Hypertext Jiangyi for Education in Laboratory Medicine[7]. It utilizes a simple web based interface to provide learning material on cases in pathology. Users are able to answer questions and interact with the learning material. This kind of material requires some knowledge of HTML and is relatively easy to produce.

More complex interactive material has been produced by the Association of Clinical Biochemists in the UK. A number of CDROMs have been produced which feature interactive cases and include rich multimedia content including videos for example interviews with patients.

ACB - Computer Aided Learning

- Thyroid Disorders (1995) by John O'Connor

- Acid Base Disorders (1997) by James Hooper

- Protein Cases (2000) by Rosamonde Banks, David Oliviera, Jane Patmore, Pamela Riches, Joanna Sheldon, Douglas Thompson & John Whicher

- Diabetes Cases (2001) by Stephen Bangert, Ellie Dow, James Hooper, William Marshall & Keith Steer

- Calcium Cases (2005) by Aubrey Blumsohn, Christina Gray, Neil McConnell, John O'Connor, Anne Pollock & Roy Sherwood

Recorded Presentations

The facility to stream multimedia content across the Internet allows the playback of lectures and presentation of either live or on-demand stored content. The choice of live or stored modes may be determined by the need for interactivity. Whilst the broadcast of material may result in a passive end user experience compared to a live lecture, it can provide the facility to ask questions and allow interaction between students and instructor. On the other hand, on-demand content may be initiated and interrupted at the user's request and this allows self-paced learning.

Critical to the delivery of material is the available bandwidth. Modem access (up to 56kbps) does not make video a realistic option. Telephone quality audio requires about 10kbps and radio quality about 24kbps. The increasing availability of broadband eg ADSL (between 128 and 2000 kbps) and T1/LAN allows transmission of reasonable quality compressed video allowing images of the presenter to accompany audio.

The Australasian Association of Clinical Biochemists (AACB) has experimented with production of low-budget multimedia material for some years. The objective has been to use standard tools and allow use of existing infrastructure and computers to play them back. The NITTY (Not In The Textbooks Yet) series [8] is a collection of short (approx 10min) presentations which are available over the Internet and also on CD. The talks are deliberately limited to short timespans to retain interest.

Live Webcasting by streaming a lecture across the Internet offers the benefits of audience participation as well as providing access remotely. Although assembling the various units for webcasting requires some organisation, none of this is overwhelmingly complex. As much attention needs to be devoted to meeting organisation as to the technical side of things.

The MISER (Multimedia Internet Streaming Education Resource) program has conducted live webcasts that have been transmitted to recipients throughout Australia and to sites in Asia. These webcasts have included video (100kbps) and have incorporated a chat server facility to allow interactivity.

Other models exist. The American Association of Clinical Chemists has been running its successful Expert Access program for several years. These audioconferences use a combination of slides (available on line) with telephone hook-up and email question-response feedback.

Podcasting

Podcasting is a way to 'subscribe' to "radio" programmes and have them delivered to your personal computer. The file provided is usually an MP3 file. A more detailed definition can be found in the Wikipedia [9]. This file can then easily be transferred to any MP3 player (it need not be an Apple iPod^{TM}). Alternatively you can listen to the programmes on your desktop computer using the podcast software.

One example is the IFCC podcasts [10].   Another example of the use of this technique is Case of the Week in which audio recordings of clinical case discussions are made available for download [11].

Practicalities

Equipment

It is necessary to assemble a range of items for the podcasters/streamcasters kit [12]. The microphones typically sold with pcs are inadequate, as are cheap webcams. However, the next grade up of equipment is still reasonably inexpensive and gives a great improvement in quality. Since the signals get heavily compressed in the streaming process and in preparation for download, it is essential to start off with good fidelity as any shortcomings are exaggerated.

Software

The Microsoft Producer application is available free from Microsoft [13] and allows the linking of video with PowerPoint. Some customisation of the interface is possible and the video quality can be set for the bandwidth available. The finished product can be burnt to a CD or the files can be copied to web servers for Internet access. With the most recent versions of the software, Mac users can also play back the presentations. There is an extensive documentation available on the Microsoft site and also the Producer Tips website [14].

One of the most popular audio editors for podcasting is Audacity[15]. It is available free under the GNU general public licence and is available for the Windows, Mac and Linux/Unix operating systems.

Problems

Ensuring the material is compatible with the Internet Explorer browser will generally cover around 75-85% of all users. Experience has indicated that around 1% of all users will have problems accessing content with a mixture of software incompatibilities and

firewall problems being the most common reason for failure. Extensive rehearsal by both provider and recipients is essential to ensure that live events will proceed without technical hitches.

Discussion

The use of multimedia and e-learning undoubtedly has the potential to enhance the learning process for students. Teachers can produce learning materials that use a wide range of media (text, video and sound) to give maximum impact in the learning process. For students it provides the ability to direct their own learning and explore teaching materials in a manner that is most efficient for them. In effect each student gets teaching materials individually tailored for their needs. This goes beyond the scope of any classroom-based traditional teaching process. Generally e-learning methods are well received by the students and can result in better performance from students. Our own experience with these technologies indicates that these perceived benefits are indeed achieved, and we have had excellent student feedback.

However, there are a number of issues surrounding the use of multimedia learning tools which although crucial are not insurmountable.

First, the technical expertise needed to create multimedia materials and course outlines is high. The time and effort required to accumulate the required skills should not be underestimated. Many of these skills require practical experience and so there are no short cuts to perfecting these techniques and achieving the desired quality of product. For example the recording of lectures for audio presentation requires the producer to take into account, the location of the lecture, the on site facilities provided by the lecture location, placement of microphones and monitoring of the quality of recording as the lecture progresses. Further complexity can be introduced if the lecture is to be videoed and synchronised with slides as in this case sound, video and slide triggers all have to be recorded simultaneously. In these cases it is often better to have more than one operator to take care of the various tasks. In our experience best results are obtained with meticulous planning. There is a high chance of failure, often from unexpected factors e.g. electrical interference from the auditorium power supply if one simply "turns up" at a location to record a lecture.

Post-production processing to generate the learning material can also be time consuming. Furthermore there can be problems if 3rd parties are used to obtain recordings since these may be in unsuitable formats or of unusable quality and this can lead to lost recording opportunities.

In conclusion, with careful planning high quality multimedia material can be relatively easily and cheaply produced. This material has high educational value and will enhance results for students exposed to it.

Examples of educational materials are available for purchase on the IFCC and Australasian Association web sites.

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