Developing an electronic teaching and training portfolio

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Abstract Technological advances, in particular the rise of the internet, have led to dramatic changes in medical education. The recent global financial crisis and issues with medical staffing have meant that training programs and universities are increasingly exploring electronic means to provide efficient and cost effective education techniques. In this article, we explore methods by which orthopedic trainees can develop their educational portfolio through electronic resources and similarly, how training or residency programs can utilize these advances in technology to both increase efficiency and enhance their teaching reputation. Finally, we explore the merits of trainees keeping track of their careers through electronic portfolios.

Keywords Education · Electronic · E-Portfolio · Teaching · Medical · Orthopedic

Introduction

The last decade has witnessed a significant increase in the number of medical students and qualifying doctors. Changes in health care systems, such as a greater emphasis on productivity, have led to increasing challenges and obstacles for the medical educator. This in turn has meant that electronic learning has received much attention; universities and training programs alike have had to explore methods of moving curriculums online [1]. In fact, nearly all medical schools in North America now employ some form of online education

[2], and all postgraduate medical disciplines have adopted some form of electronic teaching methods.

The evidence is clearcut: electronic education is a productive and efficient method of learning, comparable with face to face learning in both clinical and nonclinical environments [3]. It improves diagnostic abilities, clinical skills, and knowledge. From a practical standpoint, electronic resources can be advantageous over nonelectronic education, in that they provides [4•]:

- Safe, controlled environments that eliminate risk to patients.
- Enhanced, realistic visualization.
- Authentic contexts for learning and assessment.
- Documentation of learner behavior and outcomes.
- Instruction tailored to individual or group needs.
- Learner control of the educational experience.
- Repetition and deliberate practice.
- Uncoupling of instruction from place and time.
- Standardization of instruction and assessment.
- Perpetual resources and new economies of scale.

When the term ‘electronic education’ is used, it does not allude to the variety of types of electronic resources that are available, be it online textbooks, instructional courses, interactive multimedia, or virtual patients. A recent study by Cook demonstrated that the most commonly utilized methods of web-based resources were patient cases, self-assessment questions, and interactive feedback [5•].

Web based learning environments can be allied to nonelectronic teaching methods. For example, ‘discussion based web pages,’ where students communicate with each other and a teacher, can be allied to face-to-face teaching groups. They do, however, differ in that the communications is asynchronous, with lapses between communication. ‘Page-based’ learning is similar to lectures, where a student is given a set of information prepared by the teacher [6].

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The various types of electronic resources available can be tailored to a learner's cognitive style [6]. In doing so, an electronic teaching portfolio can be enhanced to match the student's cognitive style. Riding and Ceehema suggested that 2 cognitive styles exist: analytic or wholist. When perceiving information, wholists see "a balanced view of the whole," whereas analytics "will separate it out into its parts." [7]. With regard to web learning, analytics prefer "less structure, longer web pages, and a 'deep before broad' approach". Wholists on the other hand, prefer "more structure, shorter web pages, a 'broad before deep' approach, and social interaction." [6]

Developing an electronic Teaching portfolio

There is an abundance of online resources and selecting what to use is important. One must consider the purpose of their 'electronic education,' be it to purely increase general knowledge, prepare for exams, seek further qualifications, or even diversify skills and attributes. Furthermore, the optimum learning style of a student must be considered. Below we describe notable recourses:

Formal distance learning courses

Several universities offer purely online or 'distance learning qualifications'. Naturally orthopedic surgeons are drawn to those based on the orthopedic sciences; however, other formal qualifications may well help with career progression, such as in medical education, health care economic postgraduate degrees, or even MBAs. These types of courses tend to be expensive, with full masters qualifications costing well in excess of £10,000, however, with current disparities between the number of qualifying/accrediting surgeons and the availability of consultant or attending jobs, these additional qualifications may well be a good avenue to explore.

In the UK several universities offer Master's Degree programs based on the FRCS syllabus. These are mainly distance learning degrees but do require candidates to attend a number of days of lectures during the course of the degree. Some training programs offer a Master's Degree as part of the training program, and in doing so are thought to increase the academic portfolio of the training program.

Alternative options include free courses offered by non-profit organizations. An example in case, edX, was founded by Harvard and MIT in collaboration with some of the world's leading universities such as the University of Toronto and Berkeley University, to offer various online courses on topics ranging from clinical trials to statistics and economics. These provide a good insight into allied topics and add another dimension to the CV.

Useful online resources

There are a host of websites which provide online reference tools. These are particularly useful to look at either in a clinical setting where a computer is available, or on an internet ready device. Some of the better resources include:

Orthobullets (www.orthobullets.com)

Created very much with exam preparation in mind, this useful website provides bullet point information with access to hundreds of questions and the option of discussing clinical scenarios posed by accomplished surgeons. A recent review by Krueger actually found that significantly more answers to questions asked in 4 years-worth of OITE examinations were found on the orthobullets website, when compared with Miller's Review of Orthopaedics (5th edition) and the AAOS Comprehensive Orthopaedic Review [8].

Wheeless online (www.wheelessonline.org)

This comprehensive site has thousands of pages and images, priding itself on being the most "dynamic online medical textbook in existence". A particularly useful tool is its many links to important and landmark papers. We have noticed, however, that despite it being one of the original online orthopedic reference tools, it lacks interactivity, on occasions organization, and is rarely updated.

AO surgery reference (www.aosurgery.org)

This extremely useful tool is accessible online via a computer, tablet, or even smart phone. Produced by the AO-foundation, it provides unrivaled information for classifying and treating almost all types of fractures. It also has sections on anatomy, methods of bracing and casting, and operative techniques. It is easy to navigate and interactive.

AAOS ortho portal (orthportal.aaos.org)

Published by the American Academy, the AAOS portal allows users to pull information from various resources, including journals (JAAOS and JBJS), AAOS ebooks, CME topics, and also has access to various multimedia resources. This is unfortunately not a free site and somewhat difficult to navigate when compared with other sites listed.

Most exam based websites created focus on written exams (eg, Orthobullets). Several new sites have tried to tackle oral exams by creating 'virtual exam' environments, which mimic oral exams with virtual questions, using interactive photographs and videos. One such useful site, www.passthemrcs.com, is based on the British MRCS (Membership of the Royal

College of Surgeons) examination and offers fantastic anatomy sections.

In training examinations

The British Orthopaedic Association (BOA) and American Academy of Orthopedic Surgeons (AAOS) offer 'in-training examinations' to trainee surgeons. The UKITE (UK in training examination) is available to trainee surgeons on a UK based training program, whereas the OITE (orthopaedic in-training examination) is available in over 20 countries. Both provide a great opportunity to practice for American Board of Orthopaedic Surgery (ABOS) or Fellowship of the Royal College of Surgeons (FRCS) examinations. Moreover, OITE performance has been shown to be a good predictor of ABOS scores and pass-fail outcomes [9].

Apple/Android apps

The Apple 'App Store' now has over 900,000 apps, whereas the Google 'Android Market' boasts over 1,000,000. Unsurprisingly, several orthopedic apps are available, some of which provide fantastic 'on the fly resources.' Particularly useful apps we have identified include:

Orthotraumaopaedia

Provides a quick access to important information in the management of adult skeletal trauma. It covers most subaxial injuries categorized in 'fractures' or 'dislocations' subheading. It covers basic clinical anatomy, injury patterns, classifications, and indications for management: a useful companion for the junior registrar/intern to have on call.

OrthoEvent

Details plenty of international conferences, with information on dates, locations, abstract submission deadlines, and includes links to the conference website and contact details.

Orthoclass

A simple app providing classification systems for most Orthopedic injuries. This useful tool also provides links to the abstracts of relevant key papers.

It is also worth noting that several books are available for use through phones or tablets, either as an app (eg, Campbell's) or via a 'Kindle' app. Furthermore, many of the larger conferences now publish an app detailing talks and events, and some implant companies also publish apps with their product details, which can be particularly useful during patient consultations in clinic.

Developing an electronic teaching program for your students

Although it is easy for students to develop their own electronic teaching portfolio by using one of the many online resources, formalizing teaching and training programs into an electronic medium has many benefits. For example:

It can be cost effective

Several bodies of (nonmedical) evidence suggest that savings of up to 50% can be made by assuming electronic learning methods. This may be as a result of reduced instructor time, travel and labor savings or a reduction in the need of infrastructure [10, 11]. Clearly the type of electronic resource being set up, and what it will be replacing, will dictate the degree of savings.

Student satisfaction

A large number of studies suggest that students prefer web-based learning compared with traditional 'print' or lecture based learning. Factors that further increase learners' satisfaction include accessibility, product navigation, attractiveness, and download speeds [12, 13].

Teaching can be paused and revisited

This ensures that students have access to information at a beneficial time, eg, close to exams or at a point when they are not overburdened with other commitments: something particularly useful in postgraduate education. In fact, statistics from servers demonstrate that web-based tools are used more frequently closer to examinations [14].

Interactivity with links to other materials

The availability of recourses on the internet is quite simply vast. Computer-based tools can easily bring several such recourses together in a concise manner, enhancing the information available to a student.

Availability to large groups of people

This means that teaching can be both centralized and helps standardize the educational process [4•]. A web-based resource can be accessed globally, defeating geographical issues; important given some residency programs or rotations are based over large areas.

Helps defeat issues with reduced exposure

It has been demonstrated that exposure to clinical cases develops clinical reasoning skills. The use of virtual patients and simulation training can address deficiencies in good clinical exposure and can also highlight learning in rare cases, which one may not encounter during their training. Furthermore, simulation training has also been shown to not only improve clinicians' performances during critical scenarios, but also to increase patient safety [15•].

How to set up an electronic teaching portfolio

Despite all the aforementioned benefits of electronic over conventional teaching methods, we would endorse a period of integration rather than switching straight over to electronic means. In the UK for example, many of the training programs still adopt a traditional method of lecture-based weekly teaching sessions, but they are now recorded and placed on line for easy access. Wiki pages are also integrated on to the websites to promote further information being posted and discussion (see *percivallpottrotation.com* & *rlhots.org*). These sites have been designed with a view to potentially phase out the need for weekly lectures and transfer the lectures to a purely online medium.

Designing an electronic or online teaching course requires consideration toward the design, course content, and technical aspects. This often requires a wide range of skills and necessitates the employment of a team of design and developmental professionals.

When setting up an electronic course, it is wise to stick to a 'framework' or 'model' to add structure to the course design. Although a wide range of frameworks have been described to process course design, the ADDIE process appears to be the most popular. First described in the context of military training, it has now been expanded to many aspects of teaching. The 5 steps are:

(1) Analysis

Involves setting curriculum mapping, identifying where the material will fit into the current established training program and identifying the characteristics of the learner.

(2) Design

This stage includes setting out the learning objectives and the cope and sequence of the subjects that are to be addressed in the course.

(3) Development

During the development phase, the course is created. The technology and format ultimately employed are selected and developed. This may involve a learning management system (LMS) such as Moodle, a rapid e-

learning development tool such as Articulate, or a platform-based course development website such as Coursera.

(4) Implementation

This new electronic education medium can then be released to the intended parties

(5) Evaluation

Once the course is up and running, evaluation can take place in a 'formative' or 'summative' context, with continuous evaluation and tweaking followed by a more thorough and complete evaluation once the course is concluded.

Developing an electronic portfolio

All trainee surgeons should maintain a portfolio that highlights their progression and achievements. Portfolios are becoming increasingly important as evidence of meeting professional standards and being eligible for a license to practice medicine. They can be used to demonstrate career progression and highlight achievements and awards. Furthermore, they are useful in goal planning and encourage reflective activities.

Electronic portfolios (e-portfolios) infer several benefits. They are easily accessible and can be accessed, and therefore updated, from anywhere with an internet connection. They combat problems with physical storage and protect against loss of documents or data. E-portfolios are far more dynamic in that various mediums can be included, be it word documents, videos, or links to websites. From a managerial standpoint, a governing body can track progress and achievements of students or trainees remotely, making data collection and analysis easier, more sophisticated, and potentially cost effective.

Various websites have readymade platforms that one can use as an e-portfolio. The Intercollegiate Surgical Curriculum Pathway (www.iscp.ac.uk) is a case in example. It is an obligatory online portfolio used by British trainee surgeons. An account will allow a trainee to store information on achievements, prizes, publications, presentations, etc, but incorporates work based assessments and a surgical logbook into a comprehensive portfolio of a trainees career. In the absence of such a website, alternatives include registering a domain, which is kept up to date with relevant documents and links, or even keeping a CV on a cloud storage device.

Conclusions

Electronic teaching methods are a desirable and valuable way of educating tomorrow's orthopedic surgeons. They have been shown to be comparable with face-to-face learning and are cost efficient. When establishing an online program,

education professionals have an abundance of resources available online that can be readily incorporated.

Compliance with Ethics Guidelines

Conflict of Interest Nick Aresti declares that he has no conflict of interest. Manoj Ramachandran is a paid board member and cofounder of www.passthemrcs.com, an online educational resource.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by the authors.

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