E-learning: Is the revolution over?

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Abstract

There are many forms of technology used in medical education, only some of which are directly focused on the learning process. After more than a decade of disruptive change around e-learning we may be moving into a period of consolidation. This paper explores the evidence for such a change and the implications for teaching, learning and research in medical education.

Introduction

This paper was developed from a closing address given at the joint MedBiquitous and International Virtual Patient Conference in London in April 2010. The thesis of the presentation was that a noticeable shift from primary to translational had taken place and this marked a more general move towards the consolidation of e-learning within medical education.

There are many technologies and activities that constitute 'e-learning'. As an illustration, topics at the 2010 AMEE e-Learning Symposium included: instructional materials, simulators (such as virtual patients), case- and problem-based learning, communication (such as web-conferencing), collaboration (such as wikis and discussion boards), e-portfolios, assessment (both formative and summative), evidence-based medicine, mobile and point of care learning, lecture polling and capture (including the use of 'clickers'), and digital professionalism.

Clearly e-learning is not a single technology or technique. It is a loosely defined amalgam of information communication technologies (ICTs) used in education, usually but not exclusively mediated in some way through the Internet. Despite the label, much of what is called e-learning is defined by teachers rather than learners. A better term might therefore be 'e-teaching' to reflect both what the teacher does and what they direct their learners to do (Ellaway & Masters 2008). The term 'e-learning' should be used (if at all) to cover what learners do, much of which is unseen and beyond institutional scrutiny.

While the learning process can be richly supported or mediated using technologies, learning is still intrinsically a cognitive and embodied phenomenon. The term 'technology-enhanced learning' (TEL) may better represent the relationships between technology and learner. This article will nevertheless reflect on e-learning as its basic construct and use a number of critical lenses to consider its development along with the future of what has proved to be a particularly disruptive and intriguing educational phenomena.

Practice points

- E-learning is an aggregate of digitally-mediated education activities; learning is still learning.
- Although the use of digital technologies in medical education is widespread, only some is directly educationally focused.
- After a decade of disruptive change we seem to be moving into a period of consolidating the use of the digital in medical education.
- The e-learning context determines what is done and how it is valued.
- Good evidence is limited; scholarship needs to be more critically engaged with the broader dimensions of technology use in medical education.

How did we get here?

Connecting learners, teachers and administrators through technologies and providing near ubiquitous access to content and tools has shifted our relationship with the digital from optional convenience to near-ubiquitous dependence.

This is reflected in the ways in which the digital mediates or influences almost every aspect of contemporary medical education. For example, Google and Wikipedia are now the first point of search and reference for both faculty and learners (even though some may deny using such plebeian sources), much of the administration of medical schools has moved online and many libraries have shifted from paper to electronic collections with their once hallowed stacks being turned into collaborative learning spaces. Furthermore, the flavour of learning management system or virtual learning environment used (such as WebCT, Backboard or Moodle) increasingly defines the way the school or institution works (Weller 2007) and portfolios, lecture recording, and web-conferencing are similarly more a matter of 'how' than 'if'. As an illustration of the relatively short time in which these changes have taken

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place, the word 'web' (in the context of the worldwide web) first appeared in an article title in Academic Medicine in 1994 (Metcalfe et al. 1994), in Medical Teacher in 1997 (Cotter 1997) and in Medical Education in 1999 (Dugas et al. 1999).

A paper published in Academic Medicine in 1996 identified a number of factors why the web and 'computer assisted instruction' (CAI) was not going to change medical education (Friedman 1996). Revisiting these issues and the thinking behind them can help illustrate what has and what has not changed in the intervening years:

- *'CAI is not fully integrated into the curriculum'*: it is now quite common for curricula to be made available (in some cases exclusively) online in the form of schedules, timetables, documents, readings, policies, discussion boards etc. Despite this, low levels of faculty confidence and competence in using new media have sustained uneven levels of curriculum integration of digitally-mediated activities (Beetham et al. 2009). Situations where the computer takes on the role of teacher remain a relatively small part of the use of e-learning with some kind of blended or hybrid digital/traditional mix a more common model of use.

- *'There are no uniform standards for judging CAI programs'*: this remains a problem as shown by the many papers that come for review (and many that are published) without clearly identifying what the e-learning intervention actually was (who did what, in what order, for how long, with what, with whom etc). Although there are frameworks for helping authors to fulfil these responsibilities (Fresen 2007; Ellaway 2010a) the problem persists. E-learning benchmarking[1], while addressing institutional uptake and utility, does not get to the root of what e-learning activities actually consist of.

- *'Faculty does not test the students on material taught using CAI'*: as with curricular integration, this remains more about the skills and capacity of individual faculty members than a property of the technologies they use. Similar claims could be made about certain textbooks or approaches to problem-based learning.

- *'Computer-based educational material on the WWW does not fully exploit the problem-solving and visual aspects of the medium'*: although increasingly powerful (and relatively inexpensive) virtual worlds and virtual patients would seem to be able to address this issue, the return on the investment required to develop them remains a limiting factor. There is also a more fundamental question as to what extent 'problem-solving and visual aspects' are in and of themselves educationally desirable or beneficial (Garg et al. 2002).

- *'There are insufficient computers to access the WWW-based material'*: Web access is no longer a major issue (except in some teaching hospitals), with most (but still not all) students having their own laptops, notebooks and other web-based devices. The problem is more one of divided attention between legitimate learning activities and the distractions of the online world.

- *'The WWW does not require standardized computer equipment'*: the cost and complexity of managing diverse IT environments is less of an issue today as most students have their own computers and they depend less and less on institutional facilities. Many schools have also standardized their digital profiles through single LMS, library and portal systems. However, incompatibilities between operating systems (Macintosh, Windows, UNIX) and mobile platforms (Blackberry, Android, iPhone/iPad) can still be a problem. Even erstwhile standard webpages will work on most machines in similar but often inconsistent ways. The only truly ubiquitous format is also the most basic – text.

- *'The response time on the Internet appears to be deteriorating'*: Network and computing speeds and capacity continue to increase and although (rather like roads) traffic tends to expand to fill the available capacity, the 'world wide wait' of old is far less of a problem than it used to be, even over wifi and cellular networks. Web access over 3G wireless networks is moving us closer to ubiquitous access. All of this, of course, comes at a cost.

- *'WWW-based CAI programs tend to be poorly designed'*: there are certainly many contemporary examples of poorly designed web materials but there are also many excellent ones. Researchers such as Mayer (2005) and Colvin-Clark (2008) have developed a strong body of evidence-based practice to guide the design of online instructional materials. However, the broader the role of design in education remains unclear and requires further research.

- *'CAI programs often are not updated or refined'*: this can still be a problem although with web materials this may be more a matter of presentation and scientific currency than one of technical obsolescence. The development and adoption of educational technology standards are intended to make materials more easily updateable and adaptable and less prone to platform lock-in (Ellaway 2006).

- *'Computer laboratories have poor ergonomics'*: with the cost of computing equipment dropping and the growing ubiquity of Internet access, the time when an institution provided the majority of computers for students is passing. The design of devices has also generally improved over time allowing them to be used more comfortably in many more settings than previously possible.

From this we can see that although many technical and logistical problems have been solved, many educational issues remain. It is also clear from this that the educational value of the Internet is significantly intermingled with other uses and applications. These can be categorized as follows:

- *Reach:* the Internet supports unprecedented quantities and forms of communication and collaboration, both synchronous and asynchronous, over significant distance and time. Not only does this extend the reach of existing programs to engage learners, it opens up ways to engage many who were previously excluded. However, this reach also introduces challenges to participants (especially teachers) who do not appreciate being continuously available to their students or peers.

- *Convenience:* the Internet allows services to be both automated and personalized, often by removing direct human contact from the equation. This has revolutionized the kinds of education and training that can be effectively carried out in this manner and challenged those forms that

cannot. This is reflected in the success of social networking, in particular that of Facebook and the challenges to the sustainability of human-mediated information services such as libraries.

● *Tracking:* all actions and events in a network environment are typically tracked and recorded. Although this supports unparalleled analysis and audit of learner behaviours, there are significant ethical challenges arising from such panopticism. For instance, observing and tracking learners without them being aware that it is happening or appreciating the consequences of such scrutiny can erodes their rights to privacy and anonymity (Land & Bayne 2005).

The plurality of uses of the digital is reflected in current patterns of schools spending more on technologies for managing education and managing information than on the learning process. Compare for instance the typical budgets for institutional IT, library and educational technology services. Furthermore, the criteria for selecting and evaluating different technologies reflect a wider trend towards corporate philosophies in both healthcare and education (Usher 2009; Waring & Bishop 2010). Interestingly, although efficiency is an often-stated goal, real cost savings are seldom found, and when they are the tendency is to use them to extend services rather than return the savings.

Who does e-learning?

The differences between what the learner and teacher do in 'e-learning' have already been considered elsewhere (Ellaway and Masters 2008). Add to this mix the roles and responsibilities of administrators, librarians and the other professions involved in online medical education. The rise of e-learning has led the development of the role of educational technologist distinct from those already in the house of medical education.

Most institutions have some kind of educational technology unit. Their work may involve developing materials and tools running systems and providing user training and support. The divergence of educational technologist language and values from that of the cultures they serve can be problematic (Ellaway et al. 2006), particularly when they see their role as seeking applications of technology in every situation they encounter rather than considering the needs of learners and teachers, and whether technology should be used at all.

Educational technology units can be described using the model of service providers developed by Christensen et al. (2008):

● Solution shops: these are principally focused on finding individual diagnoses and solutions to complex and ambiguous problems. Their work involves a significant element of research and development and the resulting solution, although well-tailored to the problem in hand, is often quite costly. The greater part of the research literature on e-learning appears to come from solution shops, and research funding is often a significant way of supporting these kinds of providers.

● Value-adding process providers: these are principally focused on organizing and providing services for relatively

well-defined environments. Operational educational technology units tend to gravitate towards this model and are more about regularity and guarantee of service rather than ongoing innovation. Although the majority of e-learning (in its many forms) is provided under this model, its work has a lower profile in the literature than that of solution shops because they focus on service rather than innovation and participating in academic discourse.

● Facilitated networks: these are focused on exchanging and accessing data and services from a common pool. Examples include publishing, open source software, open educational resources (OERs) and standards organizations. In this model users are expected to know what they want and how to use what they take from the network. Examples in medical education include MedEdPortal, MedBiquitous, Medpedia and medU.

The reinforces the observation that, although educational applications make up some of the portfolio of services, many e-learning providers concentrate on service delivery, administration, planning, logistics and management. It also shows that the perspectives of the e-learning researcher and innovator, while important, do not necessarily represent the majority of e-learning practice and that the research literature may not represent mainstream practice or perspectives.

Consolidation

We scarcely think of books, pens, paper or classrooms as the technologies they are, tending instead to assimilate the new into the disregarded norm as soon as we can comfortably do so. As an example, there are now many teachers and health professionals for whom preparing for a lecture is entirely synonymous with writing PowerPoint slides (Harden 2008) and it has become quite unusual, almost unnerving, to give or be given a presentation without the accompaniment of a data projector's glow.

Of particular significance, at least in North America, is the meta-analysis carried out by the US Department of Education, that identified that: '*on average, students in online learning conditions performed better than those receiving face-to-face instruction*' (Means et al. 2009, page ix). Even taking into consideration that there are likely to be more studies published on positive rather than negative effects, these findings may be interpreted as signifying that online learning is no worse than face-to-face forms and that it is important to pay attention to the design of learning experiences of any kind. This is supported by evidence-based design principles for the design of effective and efficient digital instructional materials (Colvin-Clark & Mayer 2008) as well as many good practice guides for designing online training and instruction (Salmon 2000; Mayer 2005; Horton 2006; Ellaway 2009). Several systematic reviews would seem to concur with this perspective (Cook et al. 2008; Cook 2009).

If we follow the argument that e-learning is about educational modalities grouped by the media they use, and not, as the name suggests, a discrete educational phenomenon, then it is hard not to conclude that is the allure of the new that makes

it appear as something 'other'. This is not to say that e-learning is likely to fade quietly and unobtrusively into the background. Quite the opposite. E-learning has disrupted the status quo in many areas of medical education. Not only has it extended its reach, convenience and abilities to track and monitor its participants, it has also arguably added to its complexity and cost and challenged traditional methods and values. We can illustrate this by translating Christensen's (2003) model of managing disruptive innovation into a medical education context:

(1) *The pace of progress that education demands or is able absorb will be different than the progress that e-learning advances offer.* Sometimes e-learning moves too fast, at other times it does not move fast enough. For instance, for the use of virtual worlds may be too new to be understood by some teachers, for others they are support insufficient fidelity to usefully simulate clinical encounters.

(2) *The success of e-learning mirrors the available resources rather than its intrinsic qualities.* Political commitment can be a determining factor in the success (or otherwise) of an e-learning innovation or service. For instance, the selection of learning management system can be highly politicized around ideological as well as practical concerns.

(3) *Different forms of e-learning fit different contexts and they also tend to create new ones.* We change our values based on the possibilities of the technical environments we inhabit and tools we use (Graham 1999). For example, because learning management systems provide online discussion boards users may feel they have to use them even if there is no clear reason for doing so.

(4) *Most organizations are far more specialized and context-specific than we realize.* The power of context to redefine the meaning and even function of e-learning can significantly affect its utility and application. This identifies the need to align e-learning applications to the institutional and program environments in which they are to be used. For instance, one institution with learners working at a distance may choose to use online communication and collaboration, a neighbouring school who runs everything on-site may have much less need for this kind of support.

(5) *The information required to take decisive action in the face of disruptive technologies often does not exist.* Reflective practice backed up by research and evaluation is therefore essential to supporting good practice that is grounded in the constructing effects of the educational ecologies in which e-learning is used.

It is arguable that there have been few truly new and disruptive technologies introduced into medical education in recent years. Those technologies that are causing consternation are primarily outside medical education, in particular social networking (such as Facebook) that tend to blur and confuse the distinctions between the private and professional aspects of their users' lives (Thompson et al. 2008).

Reorienting e-learning research

Inquiry is central to ensuring that the consolidation and assimilation of e-learning is undertaken in robust and evidence-based ways. However, research in e-learning in medical education has tended to take the form of speculative essays on what is possible or somewhat repetitive intervention-effect studies (Cook et al. 2008). The rush to measure, and thereby prove the utility of e-learning, would seem to be driven by political as well as scholarly motives so as to ensure its place in medical education. A move to consolidation should reduce researchers' need for persuasion at the cost of inquiry and it should open the way for well-grounded and more precise studies that consider the experience, impact and value of e-learning within (rather than to one side of) mainstream medical education. Paradoxically, while research would seem to be an essential enabler for consolidation and assimilation, it is likely to be only in a relatively stable environment that stable and comparative research can be reliably conducted.

Although there are clearly many research topics and agendas in e-learning (Andrews & Haythornthwaite 2007; Conole & Oliver 2007), the following are proposed as being of particular importance to the advancement of scholarship around e-learning in medical education:

(1) Studies of e-learning as a phenomenon; what it is, how it relates to learning as a whole and exploring different ways of modelling and understanding its constructs and trajectories. This is particularly important in challenging the positivist tendency to treat educational technologies as black box interventions. Alternative perspectives such as tracking changes in power and authority around the use of e-learning or the cultural construction of technologies and their use should also be explored.

(2) Studies are also required into the holistic impact on the communities and the contexts in which e-learning is used. For instance, recent studies on participant behaviours and attitudes (Beetham et al. 2009) have significant implications for how we should proceed in this area. Despite the dependence of learners and faculty on digital devices to extend their cognitive capabilities (Clark 2003a), there is little positive modelling of the roles and responsibilities of health professionals in an increasingly digital world. Rather than punishing or ignoring the digital, as is often the case (Farnan et al. 2009), it is arguable that we should be actively appraising it and modelling good digital behaviours for our learners (Ellaway 2010b).

(3) The study of the institutional and individual contexts for e-learning, along with their economics, politics and interdependencies are also required to fully appreciate not only their utility but also their efficiency. During the same period time in which e-learning was developed medical education has shifted from a model of assimilating knowledge to learning how to acquire and apply it. Although information technologies are clearly enablers for such changes they are often only a small part of the plans to bring such changes about.

(4) There is a growing need for translational research into how new media technologies and the ideas that

underpin them can be integrated into medical education. As an example, Dormans' model of iconic, indexical and symbolic simulation in gaming research offers radical new ways of thinking about the design of e-learning resources and activities (2008).

While there is much to research and a need for such enquiry to inform and direct the consolidation of e-learning, there are also many risks in pursuing research in this area. Funding seems to follow disruption and innovation rather than consolidation and merging e-learning into the mainstream may paradoxically make it increasingly difficult to attract funding for this key research. Furthermore, agencies that do fund research in this area (such as the JISC in the UK and SURF in the Netherlands) are few and far between. There are also issues of legitimacy around researching the digital in medical education. For instance, e-learning is largely absent from sociological considerations of medical education (Brosnan and Turner 2009) and from the literature on simulation. Gaps between evidence and practice may therefore lead to less evidence-based practice rather than more (Strauss & Kitson 2009).

Discussion

The concept of 'blended learning' was used to describe combinations of traditional and e-learning methods (Clark 2003b). Although it implies a level of assimilation, 'blending' still distinguishes digital from non-digital forms. The benefits and disadvantages of what we call 'e-learning' are clearly multi-dimensional with student learning being one amongst many. There remain many challenges around sustainability, awareness, critical engagement, skills, politics and research. For instance, some may be disappointed with the e-learning revolution slowing down while others may be relieved to have greater stability and consistency. Consolidation and assimilation do not mean that the e-learning revolution should be rolled back, although there is a possibility that this may take the form of a rejection of the digital. The process of consolidation should (and probably will for pragmatic reasons) favour more efficient and meaningful ways of going about certain tasks with those activities that best meet their participants' needs being retained, quite independent of the media through which they are expressed.

The longer-term effects of the adoption of e-learning are yet to be seen but there are issues around its longevity. For instance, while content-based technologies from previous generations, such as books, might last for centuries, current forms might last less than a decade. Even deciding what we should keep and what we should delete is changing our perspectives on preservation and value in the learning environment (Mayer-Schönberger 2009). The e-learning revolution may not be over yet but as Winston Churchill observed, '... it is, perhaps, the end of the beginning'.

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Notes on Contributor

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Note

1. See http://elearning.heacademy.ac.uk/wiki/index.php/Bibliography_of_benchmarking

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