

Technology and the delivery of the curriculum of the future: Opportunities and challenges

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Abstract

There is increasing availability of a wide range of technology that has the potential to support and enhance the curriculum of the future. Learners expect to use technology for their learning, but this requires the development of information and digital literacy skills to maximise the potential learning opportunities. Learning resources will be increasingly delivered by a variety of mobile devices and also through different immersive and virtual learning environments. Mobile devices and Web 2.0 technology provide opportunities for learners to create their own deep and personalised learning experiences that are relevant for future professional practice. Tutors have a crucial guidance and support role for the effective use of technology for learning. There is a little evidence base to support the impact on learning for many of the potential scenarios and further research is urgently required.

Introduction

There is increasing availability of a wide range of technology that has the potential to support and enhance the curriculum of the future. This trend is unlikely to decline since new technology will constantly evolve, usually at a faster pace than the development and implementation of a new curriculum. Technology can create exciting opportunities for learners to interact with a large variety of educational content, to enable learners to interact with other learners and a wide range of different people from across the world, and for tutors and administrators to interact with learners. The potential of technology for the delivery of the curriculum of the future requires a careful consideration of both the learner of the future and the technology of the future. Effective use of technology to enhance teaching and learning will require an integration of these aspects and the new opportunities that can be created will be discussed in this article, as well as the challenges that need to be overcome.

Practice points

- There is increasing availability of a wide range of technology that has the potential to support and enhance the curriculum of the future.
- Learners expect to use technology for their learning but require development of information and digital literacy skills to maximise the potential learning opportunities.
- Learning resources will be increasingly delivered by a variety of mobile devices and also through different immersive and virtual learning environments.
- Mobile devices and Web 2.0 technology provide opportunities for learners to create their own deep and personalised learning experiences that are relevant for future professional practice.
- Tutors have a crucial guidance and support role for the effective use of technology for learning.

The learner of the future

The focus of any educational intervention should be the learner and essential considerations for the future use of technology are the underlying philosophy of the curriculum and the acceptability of different technology for teaching and learning.

The underlying philosophy of the curriculum of the future will determine how the learner of the future will need to approach life-long learning and this has considerable implications for how technology can be used to achieve this aim. There has been a progressive shift in curriculum delivery from an approach that provides large amount of information that is disembodied from future professional practice to an approach

that is based on encouraging individual and collaborative inquiry, information seeking and reflection (Cohen 2011; Hemmer et al. 2011). This inquiry-based approach is expected to sustain practice in the increasingly complex post-modern world.

There are other trends in the curriculum that have important implications for the use of technology. Professionalism and globalisation require appreciation of the plurality of experience, including different societies, patients, carers and other healthcare professionals (Eaton et al. 2011). Assessment has also started to change focus from outcome measures to an understanding of the process of learning, with formative assessment for learning being used to guide approaches for both teaching and learning (Cooper 2006).

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The context for teaching and learning has also increasingly moved to community settings which are more widely geographically dispersed than central teaching hospitals (Hamad 2000).

The present generation of learners have grown up in a world in which they have been surrounded by technology and this situation will undoubtedly continue in the future, reflecting the wider implementation of technology in all aspects of society across the world (Tapscot 2009). These 'digital natives' are high users of technology in their daily lives but this is mainly restricted to mobile devices and Web 2.0 technology, especially the use of social networks and media sharing sites (Dutton & Blank 2011). Most of the current high use of technology by young people is for social purposes but they expect to use technology for their learning at University, especially to access learning resources at a convenient time and place to fit in with their busy social lives (Creanor et al. 2008). Schools are increasingly making extensive use of technology to enhance teaching and learning, especially mobile devices, and this creates a driver for the use of this technology at University.

The technology of the future

The main trends in the development and implementation of technology for education are in the areas of mobile devices, immersive and virtual environments, Web 2.0 technology and learning analytics (Johnson et al. 2011).

Mobile devices have become widely available, either as smartphones (such as the iPhone and android phone) or tablet devices (such as the iPad or e-readers), and these have an extensive range of functions, from communication and internet access to content delivery (such as Apps and e-books). The ubiquitous nature of mobile devices has been increased by longer battery life and wider connectivity to the internet, including the implementation of cloud computing to allow lighter and cheaper devices to be used.

Individuals and groups can deeply engage with content within immersive and virtual environments (such as 3-D games and Second Life) to create rich learning experiences. Virtual patients and simulations have increasing sophistication, especially with the use of haptic technology to provide tactile and sensory feedback during the performance of practical procedures.

There has been a phenomenal increase in the use of Web 2.0 technology, which is characterised by the ease with which users can interact with other users and also to upload and download information. The main types are social network sites (such as Facebook), media sharing sites (such as YouTube), blogs (such as Blogger and Twitter) and wikis (such as Wikipedia). Increasingly there is convergence of functions between the different types of technology and ease of access through mobile devices.

The process of learning can be tracked by the use of learning analytics technology. This technology can identify the type and sequence of access to a wide range of learning resources, producing a profile of both individual learners and groups of learners.

The opportunities for technology in the curriculum

Technology is already an established component in the delivery of the present curriculum. A common approach is for a range of different learning resources, from course handouts to more sophisticated multimedia presentations, to be available to learners through central and institutionally provided virtual learning environments (VLE) or learning management systems (LMS). However, the emergent trends that have been highlighted earlier are increasingly likely to replace current uses of technology, with the potential to offer new and exciting opportunities to enhance teaching and learning.

The availability of high-quality learning resources is highly valued by students, but they prefer to access these resources using mobile devices instead of through institutional systems (Creanor et al 2008). The increasing convergence in function and improved usability of mobile devices, such as increased screen size and touch screens, is also likely to lead to more widespread use in medical education. Mobile devices can link to resources on institutional systems but downloadable resources, such as textbooks and clinical guidelines, are more convenient, especially in clinical situations (Shurtz & von Isenburg 2011). Administrative tasks that are essential for management of the curriculum, such as logging clinical encounters during placements and sending reminders, can be easily performed using mobile devices (Chatterley & Chojecki 2010). There has also been increasing interest in the use of mobile devices for authentic work-based assessments (Farenchick et al 2010).

Interactive games and virtual patients at the present time tend to be linear with little complexity (Alfarah et al. 2010; Cook et al. 2010), but immersive technology in virtual reality games and simulations can add significant value to the learning experience since the learner becomes engrossed in an environment where the virtual world becomes indiscernible from the actual world (Hansen 2008). The virtual world is perceived as physically real since the main senses (vision, auditory and tactile) are replaced by digital technology. This phase of intense immersion is highly motivating to the learner and is a key aspect of flow experience that is associated with significant learning (Csikszentmihályi 1975). Immersive technology is very costly in resources and requires significant design and computing power to deliver meaningful learning experiences. This approach to the future curriculum is likely to be limited to a few important areas, such as surgical skills training (Harders et al. 2006). To a lesser extent, computer games and quizzes can be useful but the main impact on learning may be their formative assessment aspect.

Mobile devices and Web 2.0 technology are almost ubiquitous to all learners in their social lives and are a key component of their informal learning about any topic, including their medical studies (Sandars et al. 2008). Mobile devices provide continuous access to Web 2.0 resources irrespective of time and place and provide unlimited opportunities for learners to interact with other learners to share information and opinions using either e-mail, text, web chat or the tools within social networks. Learners can quickly and easily search

the internet for information and also use media sharing sites to obtain videos or podcasts that are relevant to their learning needs. The current use of Web 2.0 technology in medical education has mainly been limited to the support of informal communities of learners but blogs and wikis have been used for collaborative learning in more formal medical education contexts (Boulos et al. 2006).

The vast number of potential learning resources that can be provided by Web 2.0 technology offers an unrivalled opportunity to enhance teaching and learning. An enormous variety and immense number of blogs, videos and podcasts by patients, carers, health professionals and other learners from across the world are freely available. The topics of these resources can range from personal experiences and critical commentaries to evidence-based reviews of treatments and practical clinical management guidelines. A typical feature of Web 2.0 technology is that comments from users can be readily uploaded and ongoing discussions with a wide variety of participants, including acknowledged experts from across the world, can be easily developed. All these potential learning resources can be accessed by any mobile device with an internet connection.

As an illustration of the educational potential of Web 2.0 technology and mobile devices, we can consider a medical student on a community placement who is interested in how mothers from different cultures manage young children with food refusal. A standard text book is likely to provide little information and the student would continue to be puzzled as to whether other mothers cope in the same way. The student may decide to use her mobile device to look for several blogs written by mothers from across the world who also have children with food refusal. She could also look at a variety of medical information websites and download a podcast produced by a support group for mothers of young children. Multiple perspectives can be easily considered and the skills required to access and make sense of the information are transferable to future self-directed learning ventures.

The informal approach to learning using Web 2.0 technology is typical of professional practice but there are potential opportunities to structure this approach to enhance learning within the more formal educational setting of the curriculum of the future. For example, a group of students could be directed to a range of different Web 2.0 resources, such as a news blog, a YouTube video and a Twitter stream, to consider the impact of rationing on the uptake of health screening. The group could then be asked to discuss the issues on their own Facebook page and produce a small YouTube video that they present to the tutor at the next teaching session.

Learning analytic technology can track the process of learning to provide formative data to inform teaching and learning (Zhang & Almeroth 2010). An essential aspect of effective feedback is to identify how the learner approaches the learning task, especially the essential metacognitive and self-regulatory processes that successful learners use to constantly plan, monitor and adapt their approach to learning to achieve optimum performance (Butler & Winne 1995). A trace of the resources that have been visited can be easily recorded and with additional annotation, such as by the use of talk-aloud voice recognition software, further understanding of the

learning process can be obtained (Hadwin et al. 2007). These traces can be uploaded to an electronic portfolio and discussed with the student.

The challenges for technology in the curriculum

Consideration of the potential uses of technology in the delivery of the curriculum may challenge some of the fundamental assumptions about teaching and learning. There is increasing recognition that undergraduate education should provide the learner with the essential life-long learning skills that are required for future professional practice (Ala-Mutka et al. 2008). Using self-generated contexts for learning, in which a variety of different resources are assembled to create a unique and personalised learning experience, is an indispensable skill (Luckin 2008). However, for this ecological approach to learning to be effective, all learners need to develop other key skills, including information and digital literacy (Sero Consulting Ltd 2007). Research suggests that many medical students are not sophisticated users of search engines and lack critical appreciation of the information that they retrieve (Kingsley et al. 2011). Students may also make inappropriate use of social network sites with public disclosure of personal and professional content (Garner & O'Sullivan 2010). Other digital literacy skills include how to effectively contribute to online resources, either content or discussions, and many medical students also appear to lack these skills (Gray et al. 2010).

The tutor is crucial for the success of using technology for self-directed learning. It is essential that tutors not only have well-developed information and digital literacy skills but also that they feel confident and competent in crafting worthwhile learning opportunities in a complex and unstructured learning environment (Sandars 2009). It is only too easy in these circumstances for tutors to revert back to tightly structured didactic teaching methods. The role of the tutor becomes that of a coach who can guide and support the self-directed learner on all the stages of their learning journey, including the use of appropriate resources, critically appraisal of what they find and making sense of the information so that it can be applied to their own practice.

A frequent comment made by tutors is that the whole curriculum will become replaced by technology. However, a more balanced view which most learners would agree with is that technology has to be blended with other teaching and learning experiences which are offered in the curriculum, such as bedside teaching and face to face tutorials. The place of technology is to enhance teaching and learning, but not to entirely replace existing approaches.

Learners may also feel challenged since they may not perceive that emergent technology can be useful in their learning. They prefer to use familiar technology and are reluctant to consider new technology that they view as a 'gimmick'. There is also reluctance to use technology that they consider to be mainly social, such as Facebook, and prefer to keep social and learning aspects of use distinctly separate (Gray et al. 2010). This aspect should be remembered by tutors.

The development of high-quality learning resources is a skilful and intensive process. This has led to the use of 'reusable learning objects' that can be shared between institutions, tutors and learners (Schoonenboom et al. 2009). These learning objects can be small discrete packages, such as an animation of the cardiac cycle, or complete pre-prepared modules that can be assembled into a larger learning resource. This has obvious attractions, especially in the present economic climate. There is an exciting potential to globally share teaching and learning resources but many educational institutions appear at the current time to be reluctant to freely share learning resources.

Maximising the potential of technology to enhance the delivery of the curriculum of the future requires that technology is fully integrated into the curriculum and the institution. Often technology is added without a clear educational rationale on how it can add value to the learning experience. Effective use of technology to enhance teaching and learning requires a skilful integration of several key aspects: the learner, the content to be provided, the instructional design to ensure that learning can be maximised, the technology to deliver the experience and the context in which the new experience will be implemented (Zaharias & Poylymenakou 2009).

Conclusion

Technology undoubtedly has a place in the delivery of the curriculum of the future and can offer a unique opportunity to deliver deep learning experiences which are authentic and relevant to both the present needs of the learner and also the needs of the professional in the future. Integration of technology within the wider teaching and learning experiences provided in the curriculum of the future will ensure that this curriculum is fit for purpose. Both learners and their tutors will need to develop a new range of information and digital literacy competences if the potential of technology is to be realised. Policy and practice will slowly evolve but awareness of the educational potential should help all medical educators to make considered decisions. There is little evidence base to support the impact on learning for many of the potential scenarios and further research is urgently required.

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