Educational technology: revolutionizing surgical education

As defined by Richey (2008), educational technology is 'the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources'. Modern-day surgical practice demands excellence; excellence in clinical outcomes but equivalent excellence in training opportunities.

Technological advances have not only helped improve patient care by potentially offering more efficient treatment modalities but also improved how training is delivered by using more novel and innovative methods (Martin et al, 2005; Satava, 2008). Yet there remains an inequity in access to appropriate resources in order to train to the highest standards, thus depriving many surgeons of the excellence they seek.

Surgeons must have a level playing field regardless of geography if they are to become highly-trained individuals. This inequity is not only geographically based but also within national training programmes in developed countries. For example, some surgical procedures have become so specialized that only a handful of surgical units or surgeons will be practising, meaning that trainees will not be able to gain sufficient experience – transanal total mesorectal excision or robotic surgery are examples in the UK. Web-based and mobile knowledge sources have emerged as the perfect solution to meet these challenges by providing on-demand educational resources which are immediately accessible. And surgery, in particular, is the perfect recipient in this respect as it is a discipline that requires an understanding of theoretical concepts underpinned by evidence-based knowledge in addition to procedural skill.

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Developing medical educational technology

The development of medical educational technology is related to the evolution of cell phone communication. Smartphones evolved and then the iPhone boom happened in 2007. Enterprisers were able to work efficiently away from the desk and consumers were attracted by on-demand internet from all over the world, while enjoying the most advanced multimedia functions. Educational institutions have started to take advantage_of smartphones and tablets, as they provide innovative ways to enhance the student's learning experience.

The last few years have seen a surge in online medical resources, mobile applications and social media, and a departure from more traditional approaches to medical education (Wexner et al, 2017). The use of online platforms and social media in the medical and surgical community has expanded, mostly based on instant and unlimited dissemination of innovative scientific content. Current trainees are as well versed in the use of technology to obtain information as they are with textbooks (Shaikh et al, 2011).

These more innovative approaches to training and promotion of high-quality education have been most recently seen through platforms such as the Advances in Surgery channel (https://aischannel.com) and the mobile technology Touch Surgery (www.touchsurgery.com). These are two examples from a vast list of surgical smartphone applications (Kulendran et al, 2014) and websites (e.g. the *British Journal of Surgery* YouTube channel; www.youtube.com/channel/UC37zz6tHYqz7twTEr3_e1pg).

Advances in Surgery channel

Advances in Surgery channel has become one of the leading platforms for online surgical education. Registered users have unrestricted and free access to high-quality surgical learning materials including live surgery performed by expert surgeons from around the world, and international conferences as well as dedicated teaching masterclasses. Initially centred around specific surgical specialties such as colorectal, bariatric and endocrine surgery, increasing demand has led to expansion into other areas.

The premise of Advances in Surgery channel is to promote optimal education as the standard, with the goal of democratizing surgical knowledge and overcoming the inequality in access. A further innovation has been delivery of dedicated live broadcasts as 'television-style' events to encompass entire topics within surgery. Over 10 000 viewers from 99 countries 'virtually' attended the summer event – a figure far greater than a traditional conference where travel and geography is an important consideration for attendance.

The most recent event took place in London: the Advances in Surgery International Symposium on the Future of Rectal Cancer Surgery recorded even larger numbers of viewers (more than 25 000 live viewers from 102 countries over five continents). These numbers tend to further increase once the content is archived as those who missed the events live are able to watch at their leisure. Such events provide the viewers with expert discussion, masterclass surgery and a series of up-to-date lectures on the cutting edge of surgery. Furthermore, as medical associations begin to realize the

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importance of online conferences and are able to offer continuing professional development and continuing medical education points, the authors expect to see even greater uptake in ‘virtual’ attendance and perhaps even the decline of the more traditional conference.

Touch Surgery

Touch Surgery offers a different yet complementary remit. This innovative platform allows the user to understand the anatomical and technical aspects of surgical procedures, reinforcing knowledge acquired from sources such as Advances in Surgery channel (Nehme et al, 2016). The validity of Touch Surgery as a cognitive rehearsal and simulation tool has been evaluated. For example, studies involving different surgical procedures have shown that Touch Surgery has key measures including content, face and construct validity to accurately represent surgical content, look realistic and differentiate between expert and novice users (Sugand et al, 2015; Brewer et al, 2016; Khelemsky et al, 2017).

Furthermore, there is a role in improving performance – Sugand et al (2016) reported that novices using Touch Surgery demonstrated significant training effect with practice and concluded that this platform is an effective adjunct to traditional learning methods.

The hi-tech future of surgical training

Beyond didactic resources, mixed reality technologies including virtual reality and augmented reality are starting to gain traction in the world of surgery (Vosburgh et al, 2013; Khor et al, 2016). Augmented reality and virtual reality technologies are designed to enable the real world to be either supplemented or completely replaced with computer-generated data.

Zhu et al (2014) reviewed the application of augmented reality in health care and found that 96% of publications claim that it is useful for improving health-care education. Virtual reality systems give users an opportunity to experience full immersion in a three-dimensional environment, which in turn enables a better understanding of anatomical relationships or clinical set-ups. The emergence of entertainment and gaming virtual reality or augmented reality headsets – such as Oculus Rift, HTC Vive and Microsoft HoloLens – has made the use of such innovations in surgical education significantly more affordable and accessible.

As this technology is further refined platforms such as Advances in Surgery channel and Touch Surgery will be able to harness this innovative tool and adapt it to allow users to be completely immersed in the learning environment – whether this be in theatre during live surgery or deconstructing the technical aspects of a specific procedure. It is time to exploit these technologies thus breaking down inequities that have historically resided in training and embrace the concept of ‘educational technology’.

Conclusions

To gain universal acceptance, studies will have to determine the validity of content and construct, performance, and the ability to differentiate between experts and novices. More detailed investigations will need to evaluate the transferability of knowledge and skills gained from such platforms into clinical settings and compare cost-adjusted benefits to existing gold standards. Nevertheless, the rapid momentum brought about by this evolving field should continue to drive standards of training even higher. **BJHM**

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KEY POINTS

- There is still inequality in access to suitable resources for training to the highest surgical standards.
- The increasing impact of online platforms on medical education can help to overcome this inequality.
- Advances in Surgery channel and Touch Surgery are among the most cutting-edge examples of this trend.
- Virtual and augmented reality will play a key role in training in surgical procedures.