Technology-enhanced learning in gastroenterology

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Received 23 March 2015

Revised 29 May 2015

Accepted 4 June 2015

Published Online First

25 June 2015

ABSTRACT

Technology is ubiquitous in today's society, and the practice of medicine is no different. Doctors also rely on technology throughout their careers for education. This includes access to the latest evidence-based literature, undertaking online learning modules, updating their ePortfolio for on-the-job recording of training progression and assessment and high-fidelity simulation for the replication of acute scenarios. Social media has created a host of mobile-device applications such as Facebook, Twitter and WhatsApp. These offer rapid access to journal updates, specialist society notifications and instant messaging between colleagues.

This commentary aims to summarise the recent and potential future uses of technology-enhanced learning in the field of gastroenterology. We hope readers find this useful, and we welcome their comments.

FLIPPING THE CLASSROOM

The flipped classroom is a novel form of pedagogy. In essence, it relies on reversing lecture and 'homework' elements. Learners are provided instructional material prior to a class/lecture session. Material may take the form of audio or video resources that focus on a particular aspect of the curriculum, and typically takes 5–10 minutes to complete. During class time, candidates are divided into groups, and are tasked with working through case-based scenarios. The scenarios are designed to explore learners' knowledge from the preparatory material. Learners work collaboratively with their peers to solve problems and enhance knowledge application. A typical format will ask groups to select the most likely diagnosis, investigation or management plan, and display responses simultaneously to generate discussion. An

advantage of the flipped classroom is the benefit of real-time feedback by the facilitator to correct misunderstandings and to answer further questions.

The flipped classroom in a medical sense was first pioneered by Charles Prober at Stanford when he used this approach during a core biochemistry course. The outcome proved positive, particularly from an attendance perspective, which rose from 30% to 80%.¹

There is to date limited experience of the flipped classroom in gastroenterology-specific learning environments; however, one example comes from residents at the Children's Hospital of Philadelphia where 10 minute long online videos were created on gastrointestinal (GI) symptom-based topics. One video was assigned to inpatient residents each week, followed by a 30 minute fellow-led interactive teaching session, in which, topic-specific cases and paediatric gastroenterology board-style questions were discussed. A formal evaluation of this learning process was positive with 100% of residents responding that they found improvements in the value of teaching. Additionally, 80% of respondents felt that fellows did a better job of teaching residents using this format.² This paper did identify a potential drawback, as half of all the participants commented that finding time to watch the videos beforehand was problematic. Further drawbacks in general of the flipped classroom may include added faculty pressures to produce video material and update as necessary.

ADAPTIVE LEARNING

Adaptive learning (AL) is a recognised means of presenting learners with tailored learning content while at the same time connecting them with their peers, based on an analysis of their learning needs. Data analytics via AL can allow instructors to gain a better understanding

To cite: Sharma N, Johnson G, Ho KY. *Frontline Gastroenterology* 2016;**7**: 74–76.

of the difficulties faced by their learners, enabling trainers to target their time for face-to-face interactions where learners are most in need of support.

The New England Journal of Medicine (NEJM) has recently launched an AL process for candidates preparing for board exams in recognition of the fact that updates in the medical field are fast paced, and clinicians' time is at a premium. The NEJM resource focuses on clinical scenarios, which aim to mirror real-life occurrences as much as possible with the knowledge plus learning system designed to determine what users know, and focus more heavily on what they do not.³

EMA Gastroenterology from Modernizing Medicine provides another example of AL. This system is designed to retain specific details of users' preferences, and offers a comprehensive approach to luminal and hepatobiliary conditions, exam-based preparation, endoscopy image capture and mobile access.⁴

MASSIVE OPEN ONLINE COURSES

Massive open online courses (MOOCs) are online education courses open to anyone with an internet connection. They are typically designed to support thousands of individuals and deliver teaching in the form of video and supplementary reading. Assessment is delivered via quizzes and graded written assignments. Peer and instructor-based interactivity is provided through discussion forums.

The advantages of MOOCs are an increased access to course content and enhanced learner convenience. It is well recognised that learners globally are often not able to attend a particular institute due to lack of funding; hence, MOOCs enable such individuals to gain accreditation from their university of choice at no extra cost. Course providers also benefit from the 'big data' learning analytics to enhance the quality of the course. However, it has been noted that there is a high attrition rate of learners, and there can be a challenge creating and updating the material (particularly videos).⁵

Examples of current MOOCs in gastroenterology include *Liver Disease: looking after your liver* by the University of Birmingham. It is a 3 week course with an expected 3 h/week contact time. The aim is to instruct candidates on the role of the liver in health and disease states, the reasons for the increasing incidence of liver disease as well as disease management and preventive strategies.⁶

Another MOOC course is *Dysphagia: Swallowing difficulties and Medicines* by the University of East Anglia. It is a 6 week, 2 h/week contact course designed to concentrate on many issues related to dysphagia, including aetiopathogenesis and management.⁷

The University of California has produced another MOOC, *Nutrition for Health Promotion and Disease*, focused on the role of diet in the prevention and management of chronic disease.⁸

WEARABLE TECHNOLOGY

Wearable technology such as *Google Glass* with image and video capabilities has an emerging role in the field of gastroenterology and surgery. In the UK, such technology was worn by a single surgical operator during an extended right hemicolectomy and partial liver resection in real time, streamed to an audience of over 13 000 people in over 130 countries globally. The overall level of interactivity was rated as good, and the experience was deemed more educational than a traditional lecture regarding the same surgical intervention. An additional advantage included instructor-to-peer interaction through live question and answer sessions.^{9 10}

THREE-DIMENSIONAL PRINTING

Three-dimensional (3D) printing allows for the development of a solid 3D object from a digital file. In gastroenterology, 3D printing has been used for preoperative identification of vascular and biliary tract anatomy to allow better surgical planning, so as to avert unnecessary surgery in patients with potentially unsuitable anatomy. It was noted that the use of a 3D object with real-depth indication could be examined and altered in a way identical to the surgical cutting plane.¹¹

In all, this methodology allowed for the development of synthetic livers (along with their complex networks of vascular and biliary structures) replicating the native livers of six patients: three living donors and three respective recipients who underwent living-donor liver transplantation.¹¹

SIMULATION

Simulation in endoscopy is not new, but certainly evolving and worthy of mention. Simulator-based platforms such as the GI Mentor by Simbionix have been validated in upper GI pre-endoscopy training to demonstrate the undertaking of more complete examinations and less assistance.¹² An Endoscopic retrograde cholangiopancreatography (ERCP) simulation study demonstrated that the use of such methodology is associated with definite training potential, and should be a requirement during training.¹³ Regarding colonoscopy, a multicentred randomised trial noted higher overall competence in the simulator-trained group.¹⁴ A systematic review of 15 studies, however, concluded that virtual endoscopy simulator training might be effective for gastroscopy, but not for colonoscopy.¹⁵ Adding to the GI Mentor comes EndoSim, which helps to provide more realistic anatomical detail and haptics.¹⁶

Endoscopic ultrasound (EUS) training in the UK is notably limited with more focus on luminal endoscopy and ERCP. Simulation-based training in this regard may, therefore, help to encourage more formal training milestones and attainment of required competencies. The EUS Mentor, for example, helps to generate real-time 3D pictures while the endoscope is advanced in addition to haptic elements allowing users to experience

resistance upon touching the GI wall.¹⁷ A more evolved simulation approach has been the use of the EASIE-R simulator, in which a study demonstrated significantly improved performance measures for GI fellows. This was concluded following a 1-day training session, which offered didactics in terms of anatomical recognition and performance of fine needle aspiration (FNA).¹⁸

For simulation to be effective, dedicated faculty must be on board to ensure effective use of this methodology with regard to their learners.

CONCLUSION

Technology in education is omnipresent and constantly evolving. Despite a widely recognised and evidence-based ability to enhance both teaching and learning, the full potential of these advances is yet to be realised. Certain technology-based avenues are not without cost such as is the case with wearable technology, 3D printing and simulation for example. However, despite this, in the next several years, we anticipate wider application of learning technologies to enhance training in gastroenterology and endoscopy to the benefit of both trainees and educators.

Contributors NS, GJ and KYH contributed equally to the writing of the manuscript and approval of the final version.

Competing interests None declared.

Provenance and peer review Not commissioned; externally peer reviewed.

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