Applying integrated video assisted learning approaches for medical clerkship – potential adaptations in the post-COVID-19 era

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ABSTRACT: Lockdowns and social distancing measures due to the ongoing COVID-19 pandemic have forced the delivery and assessment of educational material to be performed via online and virtual educational tools. Such disruption has greatly affected hands-on training programs essential to acquire clinical competencies, particularly modes requiring physical patient encounters. While most educational content has successfully been shifted to predominantly web-conferencing platforms, the essential clinical teaching at affiliated hospitals for undergraduate medicine clerkship years has been severely disrupted due to barring of students from hospital premises to minimise spread of COVID-19, presenting a problem requiring unique solutions to ensure that quality of education and subsequent healthcare is kept sufficiently high. To this degree, technological advances increasingly present several elegant solutions which may provide the required levels of educational delivery. In this article, we briefly discuss the number of options that could be deployed to aid in acquisition of requisite skills during the clerkship years, with a focus on wearable technologies and video recording/broadcasting. Given the ongoing pandemic, application of technological advances could provide, with some global coordination, the medical education community with numerous proactive solutions rather than just educational luxuries or novelties.

KEYWORDS: Video assisted learning, medical clerkship, wearable technologies, clinical encounters

Introduction

The ongoing COVID-19 pandemic has severely disrupted global educational systems including that of medical education.1 Lockdowns and social distancing measures have forced educators to adopt content delivery and assessment almost completely via online and virtual educational tools. In the context of undergraduate medical education, such disruption has greatly affected hands-on training programs essential to acquire clinical competencies, particularly modes requiring physical patient encounters.2

The Alfaisal University College of Medicine (AUCOM) in Riyadh, Saudi Arabia, follows an integrated hybrid curriculum model, employing active and passive teaching strategies including didactic sessions, team-based learning (TBL), problem-based learning (PBL), flipped classrooms and large group discussions (LGDs). AUCOM employs a spiral curriculum in 3 successive phases of organ system-based modules. Phase 1 constitutes years 1 and 2 emphasising structure and function, phase 2 (year 3) consolidates pathophysiology of disease, and phase 3 (years 4 and 5) comprises clinical clerkship wherein students rotate in 8 specialities. However, following the complete lockdown mandated by the government of Saudi Arabia in March 2020, AUCOM like many other institutions around the world had to shift from campus-based to online modalities of teaching. As AUCOM has fully embraced blended teaching approaches and online assessment modalities using Exam Soft, such a shift was minimally challenging, with all content delivery for phase 1 and 2 conducted via web-conferencing platforms. However, the essential clinical teaching at affiliated hospitals for year 4 and 5 has been severely disrupted as students have been barred from hospital premises to minimise spread of COVID-19. This situation presents a unique challenge to ensure that such essential educational experiences are delivered in a competent manner to the healthcare providers of the future.

Technology and related applications have increasingly been integrated within most facets of modern life, enhancing communication, streamlining key performance indicators and facilitating improved achievements. The medical and healthcare sectors have also greatly benefitted, with improvements in medical imaging, surgical procedures, and diagnostic technologies. Indeed, another technological beneficiary is the medical education sector, particularly in the pre-clerkship years of undergraduate education.3 Herein, we briefly discuss relevant technological solutions that can be employed to provide clinical clerkship students with unique solutions to the current challenges being faced in the era of COVID-19 related social distancing. Indeed, as has been the experience for us at...
AUCOM, while most modalities of medical education were transferred almost seamlessly to e-modalities, some aspects of medical education which demand a more ‘personal touch’ will require more drastic and radical solutions to ensure the quality of education delivered to the health professionals of tomorrow remains consistently high.

**Novel Technological Applications of Learning Modalities for Clinical Years**

The ongoing pandemic is particularly challenging for clerkship years and more practically oriented postgraduate training. It is particularly problematic to replicate the experience of clinical encounters from clinics and ward rounds for interactive patient sessions, alongside interpersonal and interprofessional communication and clinical skills training. Phase 3 (years 4 and 5) of the AUCOM curriculum. This constitutes clinical clerkship, includes 8 integrated 9-week long clinical rotations, including medicine, surgery, paediatrics, gynaecology & obstetrics, surgical subspecialty, medical subspecialty, ambulatory care and integrated neuroscience. While most online-based didactic delivery may be covered by web-conferencing applications, it is harder to mould such applications effectively to cover the required clinical and interpersonal skills training required from patient and peer interactions.

Currently available technology, such as videos, podcasts, simple virtual reality and computer simulations, are assisting educators and facilitating student learning. Innovative modalities include computer assisted learning, use of personal digital assistants (PDAs) and smartphone applications for patient management and treatment decisions, simulations to imitate patients, anatomic regions, or clinical tasks, as well as emerging wearable technologies to project images during operations. Yet, the driving philosophy underlying technology use in medical education has been to support, rather than replace, current face-to-face interaction. Perhaps due to this, medical students and trainees share a largely similar learning environment and experience with seniors from the advent of modern teaching methods.

Increasingly, smart wearables and augmented reality are potentially able to transfer traditional educational regimens into a digital format, delivering high-quality education to large numbers of students across the globe, potentially at the same time. However, some medical disciplines (such as surgical training which require significant haptic and face-to-face feedback) cannot be replaced by e-modalities. Wearable eye-wear, such as Google Glass, has been utilised to perform hands-free checklists such as in operating theatres, resulting in marked performance improvement in adherence to check-response protocols, while further applications potentially include automated recording of surgeries to simplify culpability investigations, and remote pre- and post-surgery evaluation and monitoring.

Such applications have exhibited promise in the arena of undergraduate education and postgraduate surgical mentoring, although a significant limiting factor is video quality that would be dependent on the hardware and internet connection used. Point-of-view videos could be used to enhance clinical and communication skills in undergraduate students, perhaps attributable to the ability to view actions from the patient’s point-of-view. Similar applications are currently being investigated within postgraduate arenas, such as trauma training by London’s Air Ambulance, remote suturing teaching, and combinations of point-of-view videos with interactive content. However, such applications are of course limited by the quality of the supportive infrastructure as previously discussed.

Educational applications seem to have most readily adapted such concepts, perhaps due to less complicated infrastructural requirements compared to the medical/clinical care industry. In 2014, Virtual Medics performed the first augmented reality teaching session using Google Glass, whereby a right hemicolectomy was live streamed to a worldwide audience of more than 13,000 people, with student questions displayed on a screen for the surgeon to answer in real time. While the majority of students did not consider this an adequate replacement for face-to-face, ‘in person’ training, a considerable proportion viewed such sessions as an extremely useful aspect of training. Indeed, high-quality digital education can potentially equal traditional education methods in terms of efficacy given adequate infrastructure.

**Emerging Technologies in Medical Education**

Numerous technologies have recently emerged that could be utilised in the context of a medical education curriculum, which also present significant overlap in terms of applications and could be co-deployed relatively rapidly. Indeed, our experience at AUCOM with some of the following modalities significantly aided our transition to a near-complete transition to e-learning modalities during the COVID-19 lockdown and beyond.

**Computer-aided learning**

Approaches utilising computer-aided learning (CAL), also known as a ‘flipped classroom’ approach, involves review of material online by students before an interactive session with resource faculty, focussing on exploring/discussing and solving issues and questions instead of lecturing. At AUCOM, CAL is employed for most subjects at all levels and standards of the medical education curriculum, whereby material is made available to students before resource sessions (lectures, tutorials, revision sessions etc), and material post-delivery of sessions to enhance student learning experiences.

**Mobile devices**

Mobile devices such as phones, tablets and personal digital assistants (PDAs) are routinely employed by students for numerous effects, ranging from medical queries and research, patient management, and treatment decisions. Numerous
applications are available through personalised and tailor-made apps to enhance the student learning experience. Indeed, at AUCOM, we significantly employ use of mobile devices to assist in learning modalities such as problem-based and team-based learning (PBL and TBL), as well as e-examination. Embracing such modalities allowed us to nearly seamlessly move towards e-learning and e-assessment approaches during the COVID-19 lockdown period.2,3

Simulation

Simulation methodologies aim to imitate experiences gained in-person with patients, anatomic regions, or clinical tasks. Such technology spans a spectrum of sophistication, ranging from a basic examination of body parts to complex human interactions replicating whole body physiological parameters such as mannequins. Indeed, at AUCOM, we have been utilising a combination of 3D representations of body parts and mannequins to deliver such simulation experiences.2,3

A further approach increasingly being considered has been that of Virtual Reality (VR) simulation, whereby objects are recreated as a computer-generated image simulating the physical world. Applied as an immersive experience, VR could enable high degrees of user-interactivity through a number of VR programs for medical education. Such methods, however, while potentially quite promising, would require significant investment in terms of investment and resource development.3

Another aspect of simulation currently being developed is that of augmented reality. The intention underlying use of augmented reality is to ensure added interaction or animation to traditionally static material using mobile devices such as phones of smart glasses. Such increased interactivity could deliver a comprehensive education to significant numbers of students.3

Wearable technology

Recent years have also witnessed a rapid increase in wearable devices, including smart watches and glasses, heart rate monitors and even biosensors. Furthermore, health applications on mobile devices have also gained significant popularity, allowing convenient tracking of health by both patients and healthcare providers. Indeed, technologies such as wearable eyewear could be employed as tools to perhaps enhance and facilitate a better understanding of clinical and communication skills in undergraduate students.2,3

Videos in Medical Education

The acquisition of clinical skills obtained throughout the clerkship years require extensive training and competency assurance to ensure that trainees are at an adequate competency prior to introduction into clinical settings to enhance patient safety and health outcomes.22-24 Conferring the requisite skills set for such a level of competence requires teaching strategies that allow students to experience context-dependent concepts and situations similar to clinical settings.21,25-27 Methods focusing on converting knowledge to experience through supportive repetition and guidance is essential for developing such competence. However, in the context of the ongoing pandemic, the required hands-on training for such methods have been most hard hit due to suspension of clerkship training in hospitals. Perhaps a combination of the emerging technologies may be able to provide a suitable alternative.

Further to such a rich platter of potential opportunities, simple online platforms have been employed to host videos for demonstrating essential procedural clinical skills and communication,28 whereby educators can remotely coach students with real time mobile video tools and apps. Indeed, assessment of core knowledge has also started to use a variety of online tools and platforms, ranging from online discussions forums and spaces to real-time online chatting and communication apps. Assessment of skills acquisition and performance has also begun to utilise the significant number of audio/video apps available on mobile devices to enable assessment in authentic contexts, either clinical or simulated.29

The current increased shift towards such ‘blended’ learning methods during the ongoing pandemic may improve knowledge, skill and performance of students,30 while utilising educational videos for teaching and learning clinical skills represents an emerging field of research.24,30 Indeed, videos can be supportive of various student learning styles,30-32 and can be regularly accessed via mobile multimedia technologies conventiently24,33 which when supplemented with initial clinical skill training could help maintain higher levels of competence26 and potentially accelerating acquisition of information, linking theory and practice, and stimulating deep learning, engagement, and critical reflection.27,32,34

Video instruction is also useful given greater time-management options,35 while the option of repetitive viewing may assist student understanding and retention,36 while encouraging independent learning.36 To this degree, perhaps a combination of e-learning complemented with videos could satisfactorily enable observation of skill performance techniques, patient interaction, and clinical skills and prognostic competencies.24 Furthermore, practicality coupled with cost-effectiveness (low production costs, wide reach, high information quality and variety of use options), such methods may allow students access to requisite clinical settings for their training in a safe manner that is conducive to reducing stress and enhancing quality of care.23 However, these also would be dependent upon various factors such as the required quality of video use which may extend production costs. Indeed, other factors such as the safety and security of video storage and access, alongside complex issues relating to patient confidentiality and data security during any live streaming. To this degree, while more consideration would also be required, and would inevitably elevate costs involved, such solutions are of course not an ‘easy-fix’ and would require efforts and involvement from multiple tiers of healthcare and educational administration.
Video Assisted Learning for Clinical Clerkship a Potential Solution for AUCOM Clerkship Students

Considering the utility for videos in supplementing practical training, Bright et al developed a series of videos regarding nursing and paramedic clinical skills in a repository accessible anywhere at any time via QR codes and via YouTube. Videos were filmed from a first-person point-of-view, using GoPro cameras, covering aspects of resuscitation, procedural medication, infection control and vital sign monitoring. All videos were filmed following multiple consultations with expert educators to ensure clinical skill performance on videos was evidence based and specific. Both educators and students were highly supportive of such methods and felt this was an effective tool for acquiring relevant skills and competencies as part of a larger training regime. Indeed, use of wearable cameras depicting a first person point-of-view can convey to the audience experience through the eyes of the practitioner, providing an experiential and close-to-real-life learning experience communicated to the student in a safe and controlled simulation environment.

Perhaps in the context of medical clerkship, a combinatorial approach could be taken whereby video recordings of rounds could be made by a clinician during rounds, which could then be uploaded onto an educational forum to be viewed and discussed by students. These videos could then be discussed in the presence of educators within small student groups on web-conferencing applications to consolidate knowledge and experience gained. Such methods could also explore student engagement whereby students could also use similar wearable cameras to record themselves performing a skill for subsequent assessment. Another potential approach would be for educators to live-stream videos using GoPro cameras, with students present virtually on a tablet or handheld device with the educator, which would facilitate questions and examination in near real-time (Figure 1). However, while this would enable as close to a face-to-face environment as possible, the efficacy of such a procedure would depend entirely upon the local infrastructure.

Table 1 describes the advantages and limitations of different educational strategies which could be employed in medical clerkships.

Professionally, as educators we have some responsibility to ensure that such wider digitalisation is embraced to a degree, particularly given the ongoing pandemic, which is predicted to prevent more ‘normal’ educational pursuits for some time to come.

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Table 1. Summary of novel educational methodologies describing their utility, advantages and disadvantages, and skills and competencies that could be trained with their use. Interpersonal competency assess interaction with others and with the greater community to foster and maintain healthy, mutually beneficial relationships with others, and the capacity for interdependence and collaboration. Intrapersonal competence examines the ability to self-recognize and self-interpret one’s own emotions and thoughts, while the thinking and reasoning competency assesses the level of critical thinking and independence skills acquired. The knowledge competency assesses the level of knowledge acquired and consolidated by the specific technology. Plus (+) indicates level of competency met, ranging from + (low) to +++++ (high).

| EDUCATIONAL METHOD | UTILITY | ADVANTAGES | DISADVANTAGES | COMPETENCIES |
|-------------------|---------|------------|---------------|--------------|
| Campus-based      | Lectures, TBL/PBL, practical training, seminars/tutorials | Traditional method, user comfort, large cohorts, social interaction, physical interactions | Not possible with social distancing, limited capacity, cost extensive | Interpersonal (+++), intrapersonal (+++), thinking and reasoning (+++), science (+++) |
| Web-conferencing | Lectures, TBL/PBL, seminars/tutorials | Large cohorts, convenient, most similar to traditional approaches, infrastructure largely developed, cost effective | Limited by internet/server capabilities, software compatibility issues, licensing issues | Interpersonal (+), intrapersonal (+), thinking and reasoning (+), science (+++) |
| Video recording   | Lectures, seminars/ tutorials/clinical encounters | Convenient, easy accessibility, visual impact, point-of-view training | Limited by quality of recording, limited by equipment used, limited field of view, lack of interaction | Interpersonal (+), intrapersonal (+), thinking and reasoning (+), science (+++) |
| Live streaming    | Lectures, seminars/ tutorials/clinical encounters | Convenient, easy accessibility, visual impact, impact, interactivity, point-of-view training | Limited by internet/server capabilities, not a uniform experience for all | Interpersonal (+), intrapersonal (+), thinking and reasoning (+), science (+++) |
| Simulations       | Practical training/clinical encounters | Point-of-view training, visual impact, convenience | Limited information given, lack of haptic/face-to-face feedback | Interpersonal (+), intrapersonal (+), thinking and reasoning (+), science (+++) |
| Augmented reality | Seminars/tutorials, practical training/clinical encounters | Point-of-view training, visual impact, convenience | Limited information given, lack of haptic/face-to-face feedback, limited by hardware capabilities | Interpersonal (+), intrapersonal (+), thinking and reasoning (+), science (+++) |
come. Indeed, the increase in use of health apps and self-service technologies during the recent global lockdown period (February–June 2020) demonstrated increasing levels of public interest and acceptance for such methods. Globally, technology can facilitate enhanced interactivity between educators and students previously not considered practical in terms of acceptable levels of quality. Given the ongoing situation, such ready application of technology is perhaps the most viable solution to provide a suitable balance most effectively between feasibility and appropriate impact. With some global coordination of a global faculty the medical education community could embrace such proactive solutions as one element of the ongoing efforts from recovering from the devastating impact of the COVID-19 pandemic, rather than just as an educational luxury or novelty.

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**Figure 1.** Flowchart summarising how video-assisted learning may be deployed in the clinical clerkship years of medical education to enable content delivery, acquisition and consolidation in the post-COVID-19 era. The flowchart provides a comparison between bot live-sessions and pre-recorded video approaches.
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