

Anatomy Online Teaching During Covid-19 Pandemic: The Need for Responsive Anatomy Learning Ecosystem

To the Editor, *Anatomical Sciences Education*:

We read the recently published article in ASE by Harmon and colleagues titled *An analysis of anatomy education before and during Covid-19: May–August 2020* with great interest (Harmon et al., 2021). At this juncture, we wish to share our scientific views on this article.

The Covid-19 pandemic forces students to learn anatomy from a distance and e-learning may be the only effective solution. Recently published studies stress the importance of high-quality and effective online learning environments (Evans et al., 2020; Harmon et al., 2021; Smith and Pawlina, 2021). The authors communicated that there is a clear need to shift to online teaching and that this change should be supported by higher administration authorities.

Here, we wish to share the updates on online teaching efforts in our geographical region. In Oman, a research study used applied and qualitative methods to assess online teaching and learning during the Covid-19 pandemic (Slimi, 2020). The study showed that online learning was challenging and that new styles of learning and teaching need to be introduced. During online teaching, individuals improved skills in areas such as learning approaches, problem-solving, communication, and information technology (Slimi, 2020). The challenges included network connectivity problems, poor time management, and technical issues with audio and video platforms. Interestingly, this study revealed that a total of 77% of participants found high value in their online experience and were fully satisfied (Slimi, 2020).

An editorial from the Malaysian subcontinent also highlighted adaptations undertaken during the Covid-19 pandemic (Foong, 2020). It noted that the pandemic presented an opportunity for faculty to improve their teaching methods during new online, live, and virtual assessment sessions. These exercises provided better hands-on experience (Foong, 2020). Another study highlighted how the educators coped with the unprecedented Movement Control Order in Malaysia (Nasri et al., 2020). The same study discussed how teachers and students adapted their interactions, pedagogy, and assessments. Diligent planning, development of online teaching methods, student diversity, and innovation in used technologies were considered key to teaching in this new environment (Nasri

et al., 2020). Rashid and colleagues postulated that pre-clinical online teaching may be easier than traditional in-person learning, but the lack of infrastructure and equipment prevents its successful implementation (Rashid et al., 2020). In addition, internet connection was reported as one of the major obstacles (Rashid et al., 2020). Another study described the challenges of learning without patient contact (Wilson and Shankar, 2021). Virtual or extended reality technologies were suggested as possible solutions to some of these barriers in online learning and assessment. In addition, the authors pointed to the paucity of literature on gross anatomy online teachings as a significant barrier. In future studies, ascertaining the teaching experience and information technology competency of each anatomy educator will be important because this experience could significantly bias research on online learning.

Online communication and discussions have been found to improve the quality of students' e-learning (Jiang et al., 2021). Many nations provided guidelines suggesting that medical schools explore substituting students' clinical rotations with a virtual clinical simulation which could improve clinical clerkships in even a non-pandemic setting (Hutchings, 1996).

Before the Covid-19, many online databases were unused but have since been extensively utilized. In this regard, Toklu and Prashad (2020) study found that database research and data mining especially of electronic medical records increased significantly during the pandemic. As anatomists, we feel that similar analogies may apply to the utilization of online atlases which are excellent resources to learn gross anatomy in the absence of cadavers. Notably, students have accessed and adapted to these new information technology resources easily.

Estai and Bunt (2016) suggested evolving the anatomy curriculum for both short-term and long-term purposes. Integrated courses may limit cadaver usage but also generate more interest in the minds of the students. A few researchers believe that students learn better when they are exposed to integrated multimodal and system-based approaches (Estai and Bunt, 2016).

We as anatomists also feel new innovative methods in anatomy teaching are needed. Perhaps, it may be high time to incorporate artificial intelligence in anatomy teaching. Earlier published research showed how the combined computer vision, three-dimensional (3D) computer-generated images (CGIs), and real-time user-machine interactions helped students learn anatomy (Rodriguez-Pardo et al., 2015). The same study tested the interactions of augmented reality, level of interaction, and application difficulty with anatomy learning. The results showed strong evidence that a better user experience in augmented reality applications is needed.

Magnetic resonance imaging (MRI) methods have been combined with modeled healthy anatomy and artificial intelligence to detect brain anomalies in an unsupervised manner

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(Baur et al., 2021). Datasets of MRIs of diseases including microangiopathy, glioblastoma, and multiple sclerosis were assessed with both supervised and unsupervised U-net models. The unsupervised deep learning model was ultimately very effective in detecting a wide range of brain anomalies (Baur et al., 2021). Studies like this demonstrate that we are in the digital age of medicine, and students should be trained in artificial intelligence to be successful with these new technologies.

Anatomy 3D software packages may be beneficial but are costly. Instead, we feel that institutions should start preparing and storing their own recorded practical sessions and other electronic resources in their departmental repositories to prepare for future lockdown situations. One caveat is that online sessions do require a fast internet connection with adequate bandwidth. Remote areas with decreased technology infrastructure will be disproportionately affected by this. We feel that a proper responsive ecosystem needs to be created for active online learning. We think that more e-learning methods and virtual community platforms based on various social, educational, cultural, financial, and geographical diversities could better learning outcomes. Modern learning materials, interactive media, information technology, and new devices can provide a better learning ecosystem. Teaching has to be made a community property (Hutchings, 1996).

As stated in a recent editorial, anatomists need to be leaders and should demonstrate skills to cope up with crisis in addition to being educators (Smith and Pawlina, 2021). Anatomy educators have a bigger role to play and must learn from the benefits and shortcomings of teaching methods employed during the Covid-19 pandemic.

We applaud the excellent work by the authors and thank the editor for publishing such an important article.

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