

# How Can We Improve the Delivery of Urology Teaching to Medical Students Using Modern Educational Techniques?

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**Abstract:** It is generally well-known that the medical school curriculum is becoming increasingly busy, more so with the COVID-19 pandemic. By itself, urology education will need to adapt to meet the changing circumstances, but it remains uncertain on how best to address this need. In this article, we will discuss several methods that will allow institutions to ease and overcome pressures using modern educational techniques. These methods can be classified based on the aspect of the curriculum they seek to improve, namely core-curricular teaching, anatomy training, virtual reality, and electronic learning opportunities. We anticipate that the implementation of these suggestions will enhance medical school teaching.

**Keywords:** surgical education, urology, medical school curriculum, modern educational techniques

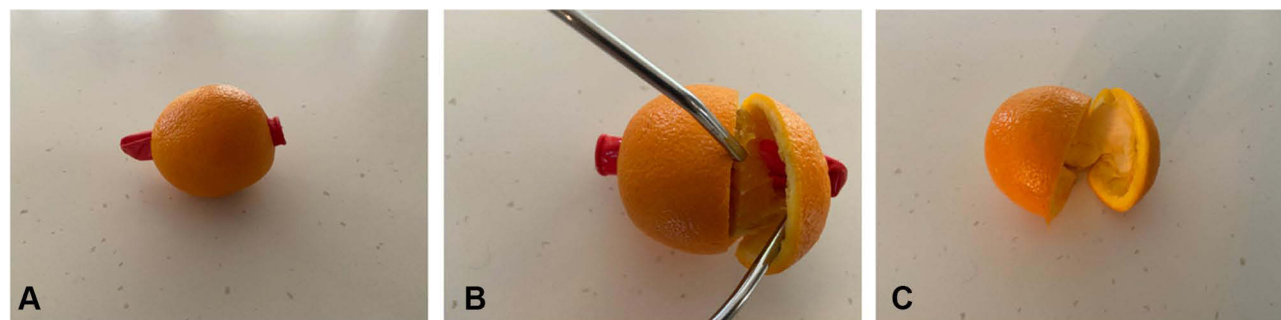
## Background

Urology-related emergencies account for >20% of all acute surgical admissions and 5%–10% of general practitioner visits.<sup>1</sup> Yet, urology teaching only appears in 37% of UK medical school curricula.<sup>2</sup> Therefore, there is a clear need to improve the extent of urology education and the quality at which it is administered. There are many views on how best to address this unmet need. However, based on our experience and the evidence we will describe, we believe that the most fundamental components of medical school education are anatomy demonstrations, lectures, virtual reality-based, and electronic learning opportunities. Hence, focusing our efforts on improving these aspects should be the priority.

## New Approach

### Bridging the Gap Between Theory and Practice: Anatomy Training

In the classroom, students who engaged with interactive anatomy significantly improved their academic performance.<sup>3</sup> Whilst in clinical practice, 32% of claims to the Medical Defence Union are due to anatomical errors.<sup>4</sup> Such evidence illustrates that anatomy teaching is essential for future doctors, both in education and practice. Current anatomy teaching is often performed using cadavers, which are expensive and sometimes inaccessible. Hence, we ought to develop sustainable alternatives. Whilst anatomical videos and virtual models have been proposed, they too are limited, particularly given the lack of tactile learning. One more promising suggestion is the use of simulation models, which offers similar opportunities for anatomy demonstrations without the associated challenges. Simulation exercises with models can be performed via online platforms with an instructor. One example of a model for prostatectomy is illustrated in Figure 1. Of course, one may argue that the models are not cost-effective and do not mimic human tissue. However, findings from a study conducted by Matsumoto et al (2002) addresses this criticism. The group showed no significant difference in endourological performance between anatomical models that cost \$20 versus \$3700.<sup>5</sup> Therefore, models do not need to be expensive to be useful. Similarly, given the speed at which technology is progressing, anatomical models



**Figure 1** A prostatectomy model was used to teach medical students. **(A)** A balloon is inserted through the orange to act as the urethra. **(B)** The urethra can be stretched and incised as in real cases. **(C)** Once the pulp (benign tissue) has been removed using surgical dissection, the skin (normal prostate) can be closed.

will soon be sufficient to mimic cadavers for demonstration purposes. For inspiration, we only need to look at companies like Peninsula Radiology Academy™ who have made a renal pelvicalyceal system that responds to fluid, akin to a hydronephrotic kidney.<sup>6</sup> During times where some universities have completely abandoned dissection, anatomical models may provide the best solution.

## Virtual Reality (VR)

Traditional anatomy teaching encompasses lectures, cadaveric models and 2D atlases. Advance 3D VR software, is a stepping stone into the future of sustainable and interactive learning of anatomy. Chen et al in 2020 have shown that skull virtual learning resource is as effective for learning. VR allows for one to learn at their own pace, instead of designated anatomy learning time slots.<sup>7</sup> As VR technology evolves, one may be able to enter the virtual surgical room and operate. Given the extra precautions mandated during the COVID-19 pandemic, this will provide students with the opportunity to operate in a virtual stimulated setting.

## Turning Medical Education Upside Down: Flipped Classroom Approach (FCA)

Stuart and Rutherford (2003) analyzed 1353 questionnaires to show that a student's attention span peaks in 10–15 min and then declines.<sup>8</sup> Despite this data and those from similar experiments, UK institutions still hold hour-long lectures. Whilst some institutions have attempted to solve the problem by using audience response systems such as clickers, these were not associated with increased academic performance.<sup>9</sup> A more promising alternative is the flipped classroom approach (FCA). Students learn core content on their own, then apply their knowledge in role-play, designing concept maps, and group discussions online or in person. Studies have shown medical students exposed to the FCA scored significantly higher in their modules than those attending traditional lectures.<sup>10</sup> Furthermore, Morgan et al showed that a flipped classroom curriculum would decrease the amount of required teaching time without detrimentally affecting student performance on examinations.<sup>11</sup> The time saved can be re-allocated through the implementation of ideas that we will outline in subsequent paragraphs. It is worth noting that the format of FCA places more importance on self-directed study. Whilst various approaches can be taken to complement FCA in this regard, few seem more effective than the use of electronic-learning (E-learning) resources.

## Utilizing the Cloud: E-Learning

E-learning involves the use of electronic media for medical education; its implementation has shown to be beneficial. For example, Schneider and Albers (2015) found that students using computer-based cases scored 20% higher in urology exams than those using paper-based methods.<sup>12</sup> This is particularly effective as a teaching tool for urology as it helps students practice imaging analysis and urological procedures, skills that are often essential in clinical cases, from the comfort of their own homes. As an example, Heinrich Heine University in Dusseldorf uses a web-based learning system, called CASUS™, which provides students with clinical cases in which they assess imaging data to devise a management plan. Students receive instant feedback regarding their performance and can watch videos from the operation theatre to

gain an impression of the techniques used. Manalo et al 2021 created a 1-week virtual urology course with surgical video reviews and case-based exercises, enrolling nine medical students. All students reported an increased understanding of common urologic diagnoses by an average of 2.5 points on a 10-point Likert scale with 56% students reporting increased interest in urology as a specialty.<sup>13</sup> As the longevity of the COVID-19 pandemic has become increasingly more prevalent, virtual teaching can be intertwined with the current medical curriculum.

## Evaluation

### It is Easier Said Than Done: Potential Challenges

Many of the ideas we have suggested are theoretical; it is also important to consider their feasibility on an institutional level. Despite the benefits of E-learning, only a few institutions have adopted E-learning approaches for teaching, principally owing to the associated costs. For example, Harvard Medical School has spent over \$200,000 on facilities needed for their E-learning modules.<sup>14</sup> Not all schools have this budget. Similarly, not all schools have the online resources or faculty to implement FCA, which is optimized with a class size of  $\leq 18$ .<sup>15</sup> Because of such difficulties, institutions should consider a more measured approach to implementation, perhaps collaborating to form an E-learning repository and maintaining a combination of lectures and FCA. Results from a multicenter, cross-sectional evaluation of urology teaching in the UK showed that 20.1% of foundation year 1 doctors received no medical school attachment in urology prior to working on the hospital ward.<sup>16</sup> The results indicate urology teaching can vary considerably in the UK, which prompts speculation of inadequate “lobbying power” within our current medical school curriculum. These are a few challenges that may prevent the advancement of medical school urological teaching.

## Conclusion

Optimal urology education using modern educational techniques can take many forms. We have proposed that improving virtual teaching has the most potential to enhance urological medical education. However, we should also consider the difficulties associated with the implementation of these approaches; addressing these challenges should be the primary focus in the coming years.

## Disclosure

The authors report no conflicts of interest in this work.

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