Accelerated Deliberate Practice: Virtual Reality for Learning & Assessing Pupillary Examination

rco2022.07401fd Dr. Michael Williams MRCOphth MD MMedEd, Centre for Medical Education, Queen's University of Belfast.

Introduction.

Why? Pupillary examination is a key part of clinical assessment in many settings, from Ophthalmology to ED, Medicine to General Practice, Pre-hospital Care to Optometry practice.

How? Healthcare students learn this skill various ways.

Simulated patients provide opportunities to negotiate the performance of an examination with a real person, but only one pupillary abnormality can be simulated: the fixed dilated pupil. Medical mannequins and physical models exist, but with functionality comes expense. Furthermore, simulated patients and models are a limited resource, only being available in teaching settings. Students are sent out on clinical placements in the hope that a) they will be exposed to a range of abnormalities, and b) can examine patients, and while in general this works, its opportunistic.

The Challenge. How do healthcare students get sufficient opportunities to practice pupillary examination, so they learn to consistently elicit and accurately recognise abnormalities, and when with a real patient, can then focus on the person rather than the next steps in their examination?

The solution. Virtual reality (VR) provides an obvious solution.

I worked with Sentireal (https://www.sentireal.com/post/virtual-clinical-classroom-ophthalmology-student-vr-training Accessed May 2022) to create an app for the Oculus Quest I & II, a *de novo* virtual world in which a virtual patient can be given a pupillary abnormality and her pupils examined.

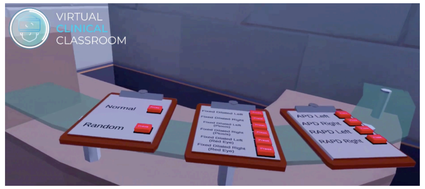
Figure 1: stills from the user's view.

Top: Clipboards offer users a choice of 12 different pupillary abnormalities, including 'normal' and 'random'. Users press one of the buttons to choose.

Middle: Users are prompted to greet the patient. Pressing the button results in a short audio introduction to the patient, as a reminder that this matters!

Students are also able to turn around and (virtually) wash their hands.

Bottom: The room light be be turned on or off using a switch on the wall: pupils behave accordingly.



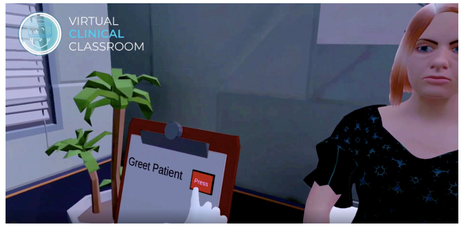




Figure 2: more stills from the user's view.

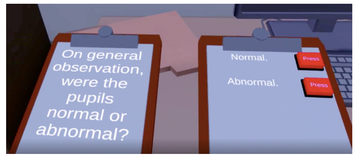
Top: Pupillary examination in progress: immersed in the virtual world, the user has to pick up the pen torch, and make the same movements as would be made in real life to assess direct and consensual reactions, perform the 'swinging flashlight test' and test accommodation.

Middle: the user can sit or stand, can walk towards the patient to get a closer look, and move around the virtual clinical room.

Bottom: at the end of each assessment, the user can do a brief test, and get feedback.







Evaluation.

All final year medical students in Queen's University of Belfast do an exercise, in small groups, called the 'Simulated Eye Clinic'. It was in person in 2021-22. One station was pupillary examination using the VR app. Over 250 students each used the app to examine 2 abnormalities: an afferent pupillary defect and a fixed dilated pupil in a red eye.

As the instructor, I learnt how to manage this experience without rushing, with 10 minutes available for each pair of students. Most students had not used VR before, and there was almost universally a shocked but delighted reaction on putting on the headset to enter the immersive world. A 4m² space was available for safe movement.

In an opportunistic survey of 69 students, over 95% agreed or strongly agreed that use of the app improved their knowledge of and confidence in pupillary examination, and that they would use the app in their spare time if it was available.

Free text comments provided richer insights:

"...allowed me to see an APD which I'd never seen before!"

"Great APP, would use this at home if I had it"

"...takes the anxiety out of performing in front of students + so you can make mistakes"

"I LOVED the VR – something so innovative and a bit different to keep the learning process interesting!!"

Discussion.

It was noteworthy that one student valued the *privacy* of the virtual world, allowing mistakes to be made without loss of face, though - if desired - the user's view can be *cast* to any device or screen, perhaps useful for assessment.
The app engaged students, introducing a playful tone to their learning, and hopefully therefore improving retention. Prospective studies on this are required.

Conclusions.

VR offers an opportunity for students to engage in clinically relevant deliberate practice, with an SP who will never tire, and have whatever abnormality you choose her to have. However it is important not to be distracted by the novelty and technical aspects. VR and AR are merely tools, and should be used as part of an overarching planned pedagogical strategy. Furthermore sight must not be lost of what really matters in healthcare: the real patient. VR and AR are coming to healthcare education, and it is incumbent on us, as healthcare professionals, to get involved in development of emerging virtual worlds.

Contact: m.williams@qub.ac.uk Declaration: the author has a commercial interest in the app.