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Defining virtual, augmented and mixed reality in physiology education

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Over the past decade, a large portion of my time has been spent working on integrating technology into physiology teaching. It has been an enjoyable and rewarding journey, especially learning how to create virtual models of organ systems and anatomical structures for students to navigate through using devices such as virtual, augmented and mixed reality. In March 2020, when social distancing was enforced and teaching conducted online, our team immediately thought it would be fantastic to convert the virtual reality lessons into online sessions to engage students within their homes. However, we soon realised that although technology can theoretically allow for learning at any time in any place, this often needs to be a specific goal during the lesson’s creation. Only one of my students owned a virtual reality headset, and no-one had access to the mixed reality device I’d been planning to use, the Microsoft HoloLens, rendering these lessons unusable. As such, we had a completely virtual, engaging and interactive series of laboratories and physiology learning sessions that were completely unusable outside of the laboratory environment (Fig. 1).

The need to run classes off-campus certainly helped to motivate the conversion of many teaching resources into entirely online delivery. I am very grateful to have received the 2019 David Jordan Teaching Award to help share as many physiological resources and online learning tools as possible, and this placed me in good stead for creating a wide range of online physiology curricula. I have now been teaching through a variety of modes that are entirely free for students, such as using Instagram (@physiologywithchristian) to run informative sessions, YouTube for video content (Physiology with Dr Christian) and trialing different forms of educational media, such as converting my Physiology and Anatomy adventure game into a completely free fully online platform (https://www.physiologywithchristian.com/game – check it out!).

As integrating virtual, augmented and mixed reality into our physiology classes has been a recent highlight for teaching, I thought it might be helpful in this article to explore these terms and their use in the literature.

What is virtual, augmented and mixed reality?

One of the most confusing things to comprehend when entering the technology-enhanced space is the terminology used. Virtual reality, augmented reality, mixed reality, extended reality, and cross-reality are all widely contested terms.

Virtual reality, augmented reality, mixed reality, extended reality, and cross-reality are all widely contested terms. The most helpful source for virtual reality is to decode some of these terms is an article by Milgram and Kishino (1994). Here, the authors describe the use of a “Reality-Virtuality Continuum”. In their model, one end of the spectrum is the real environment, with the other end the virtual environment (i.e. virtual reality). Augmented reality fits in the middle, while mixed reality is employed as a somewhat umbrella term encompassing the entire spectra. With the introduction of new devices explicitly marketed as “mixed reality”, this definition may be aging, so I’ve done my best to summarise these terminologies below.

Virtual reality: The user’s senses (sight, hearing and motion) are fully immersed in a synthetic environment that mimics the properties of the real world through high resolution, high refresh rate (constantly updating) head-mounted displays, stereo headphones and motion-tracking systems (Moro et al., 2017). Augmented reality: Using a camera and screen (i.e. smartphone or tablet) digital models are superimposed onto the real world. The user is then able to interact with both the real and virtual elements of their surrounding environment (Moro et al., 2017).

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References


On 12 March, universities across Ireland were forced to close their doors. Today, while control the spread of SARS-CoV-2 virus. This impacted hugely on education, presenting both opportunities and challenges for all students including myself. As a third-year physiology student, I was now forced to alter my study regimen and contend with an uncertain format for examinations.

Online learning, especially in higher education, has become more prevalent over the last few years; however, the COVID-19 crisis has forced institutions at every level of education into a paradigm shift in teaching and learning. Traditional face-to-face learning, as we know it, has been abruptly interrupted, and we have had to adapt to new learning styles, and a new "normal." The rich learning experience afforded to us by conventional classes has been drastically diffused and we have suffered from the absence of practical laboratory classes, tutorials and seminars. Conventional learning prior to COVID-19 fostered an affable learning culture wherein we could freely ask questions and seek clarification about all aspects of course material thus ensuring the synthesis of the various concepts taught. Today, while our lecturers are making every effort to encourage us, students, to ask questions via email or discussion boards, many students, myself included, are reluctant to do so, now more so than ever.

In my opinion, a great degree of self-discipline is required to achieve the same grades working remotely. Personally, I am a creature of habit and once adapted to my new routine I worked quite well from home. I considered myself very lucky and privileged to have access to all of the technological devices essential to attend high grades whilst working remotely; I own a smartphone, laptop, textbooks, and my home has excellent broadband access. Furthermore, I live in a home environment conducive to study, affording me space for optimal concentration, productivity, and taking remote examinations. The college library is where most students go to knuckle down and accomplish the tasks at hand and it’s difficult to recreate this space at home with so many distractions for fun. The library facilitates delineation between academic and home life both mentally and physically; online learning without this separation seems overwhelming at times.

Personally, one of my major apprehensions was the degree of uncertainty regarding how exactly the lecture to be carried out remotely. We received daily emails informing us of meetings between the relevant bodies and that all steps were being taken to ensure that online examinations would not impact our grades. A petition circulated among students calling for universities across the country to follow the actions of many universities in the UK and implement a “no detriment” policy to ensure final grades would not suffer as a result of the COVID-19 pandemic. This did not occur; however, we were informed of a similar and arguably equally fair strategy whereby students unhappy with grades awarded following summer exams would be allowed to repeat unapped in Autumn. This was followed promptly by emails from the various lecturers specifying requirements for each module. This consideration, and clarity by our lecturers, greatly ease the concern of many of my classmates and myself and effectively helped to motivate us at a time when even enthusiasm had begun to dwindle. Examinations were of an open book format focusing more on our understanding of content than the simple recall of facts.

Older generations may assume that my youth and my online generation is a "technological genius," however, unlike many students, I would consider myself quite traditional in my approach to learning and at first, I was a bit uneasy. I tend to print off lecture slides, write all my notes by hand, and refer to physical copies of textbooks and hardback books. I believe that my style of learning left me at a disadvantage when both learning and examinations were moved online. I often struggled with understanding mechanics of "speed typing" during exams, and believe that those who were more tech savvy would be at an advantage. Some challenges were also presented with the exams that were to be handwritten, scanned and uploaded all within 120 mins; technical difficulties with failed scanning and uploading proving to be the main points of struggle.

One may have thought the usual pre-exam hype and the post-examination autopilot would be eliminated, but rather, these events occurred in a virtual sense, and to some extent were worse than ever before. Rather than comparing which questions we chose to answer and what information we included, the most common question asked in the year group was now “how many words did you write?” I had to question this statement to an instant feeling of inadequacy. I found myself trying to reassure myself with the well-known phrase “quality over quantity” and hoped that answering the question asked was more important than including additional but irrelevant information.

The ultimate impact of online learning on educational opportunities should be assessed on an individual basis. As I am, I said, I’m one of the lucky ones, I’m driven and determined to do well, (have access to resources and enable environment to work in but I would have serious concerns for those who aren’t as fortunate. I know that I will not look back on this semester as fondly as others; however, remote learning has not been all that bad for me. I certainly have not missed my hour-long morning classes, and a few of my final exams, I had begun to adjust to this new examination format. I do hope that in time, through utilising all resources available, and the expansion of our technological skills, we will adapt to and overcome the challenges presented by remote learning if it is to be the consistent "new normal".

Róisín Ni Dhonnabháin is a third-year Physiology Student from University College Cork.

Making the most of online learning in lockdown: A student perspective

Obituary: John Bligh 1922 – 2020

By that time, John had gained international recognition for his work in the area of temperature regulation. He is best known for his groundbreaking work on mammalian temperature regulation where the balance between heat production and evaporative heat loss was a matter of great interest. John was a true “gentleman scientist,” a cheerful, uplifting man, generous and insightful in his advice, a delight to work with, not least because of his sense of humour. In response to the invitation from the Chairmen for questions from the floor at the Climatic Group meeting, John’s retort was “More questions? I already told them everything I know!”

As a mentor, John taught us that, in research, the investment in people is much more important than investment in infrastructure and instrumentation. He was a powerful advocate for honesty in science. He will be remembered by all who had the privilege of working with him as a kind, approachable, and extremely helpful and supportive mentor. He always had time for people. His wisdom provided guidance not only in our research, but also in our daily interactions as scientists and colleagues, something that today is not always offered by mentors and not always appreciated by the mentored.

Written by Igor B Miejkovic (Department of Automation, Biocybernetics & Robotics, Jozef Stefan Institute, Ljubljana, Slovenia), who was John Bligh’s host, colleague, student, and most importantly - his friend.

Obituary: John Bligh

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