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Review Article

The Virtual Transformation of Medical Education: Post COVID-19

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Abstract

Introduction: COVID-19 has presented a unique challenge to medical training institutions, thrusting them into the virtual realm. While some have deftly navigated this new terrain, others are still finding their way, grappling with the challenges of online learning. However, the adaptability and resilience of medical schools shine through as this new norm in medical education is no longer a novelty but a routine. We are witnessing the transformation from online teaching and assessment to online virtual clinics and student consultations. We can revolutionise teaching and learning by incorporating various gadgets and tools, including virtual and augmented reality. The reality is that virtual teaching and assessment are not just stopgap measures but a permanent fixture in the future of medical education. This shift, driven by the resilience of medical schools, will have far-reaching implications for medical education worldwide.

Purpose: This paper delves into the profound impact of COVID-19 on medical education, particularly the rapid shift towards virtual learning. It also presents a hopeful vision of innovative alternative methods that can enhance the learning experience for medical staff and students. The urgency of this exploration is not just underscored, but it is a pressing need, as the world of medical education is undergoing a seismic shift. We must understand and adapt to these changes immediately to ensure the continuity and quality of medical education.

Methodology: The impact of COVID-19 on medical education, a field that necessitates close patient contact, is profound. This review, authored by Prof Dr Zabidi-Hussin FRCPCH, a Fellow of the Royal College of Paediatrics and Child Health of the UK and a member of the Expert Panel of the European Research Agency, examines the current trends in medical education in response to COVID-19, particularly in the pre-clerkship curriculum. It also discusses the exciting opportunities and challenges in the post-pandemic era. COVID-19 has accelerated the adoption of online teaching and learning and is also expected to ignite a wave of innovation in medical education. It is anticipated that the rise of novel learning approaches driven by student-led initiatives and facilitated by various technologies will herald a new era of medical education. The necessity and urgency of understanding and adapting to these changes cannot be overstated.

Findings: The COVID-19 pandemic constitutes an ongoing threat and, thus, is promoting continuous innovation rather than temporary changes in medical education. As such, changes triggered by COVID-19 impose challenges and opportunities for medical education, allowing us to rethink our overall approach to medical education.

Significance: The 5-year medical programme may need to be revised entirely as students may be given opportunities to enrich their real-life experience to witness, help and see all the humanitarian disasters. The first year could start with total exposure in the wards rather than in the classroom, in the Intensive Care Unit (ICU), talking to the sufferers of diseases and relatives of those suffering. This will significantly impact these young minds, and measures must be taken to mitigate the psychological distress that may happen consequently. Those real-life exposures will strike these young minds positively because this will etch a permanent image as they witness the carers' illness and suffering.

Keywords: COVID-19, Future Trends, Medical Education

Introduction

The convergence of the physical and virtual worlds has given birth to the era of Industrial Revolution 5.0. Adopting this interaction opens a vast space for innovation and creativity. From remote robotic surgeries to augmented and virtual reality in rehabilitation, from remote 3D organ printing to virtual consultations, these are just a few examples of healthcare activities that have emerged in the last five years. For medical students, this accessibility to IR 5.0 and the human-robot interaction heralds a complete transformation of the medical curriculum. The days of rote learning and memorisation are fading, with the emphasis shifting towards understanding and application. The recall of knowledge in examinations may soon become a thing of the past.

Novel approaches to learning that involve student-led initiatives are likely to become popular and mediated by various technologies—online learning resources and assessments. As online education is expected to play a prominent role in the post-COVID-19 era, such transitions offer opportunities and challenges. (KJ Kim,2020)

The COVID-19 pandemic has also critically impacted how academicians should plan and deliver medical education. There is an opportunity for medical education to be thoroughly revised from the current five to six years to a lesser duration. (Dent JA, Harden RM, Hunt D. 2021)

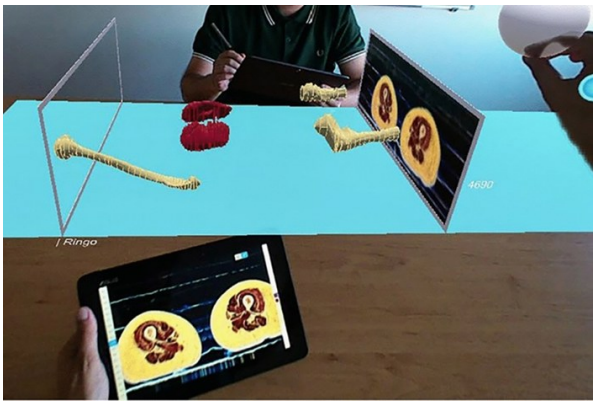
The rapidly adopted virtual learning environment during the COVID-19 pandemic will likely increase student autonomy in small and large-group learning settings, which had never happened before. (Belovich et al., 2022; Gill, Whitehead, and Wondimagegn, 2020)

Resources for supporting student learning are necessary during the online teaching approach. This can be utilised in several ways, including team-based and flipped learning and the Massive Open Online Course (MOOC), such as lecture videos, online reading materials, and quizzes (de Jong et al., 2020). It may take a significant amount of medical faculty time and effort to develop such resources, especially in resource-constrained settings.

Charles Stuart University was obligated to cancel all classes on campus in 2020 due to this pandemic (Claudia M. Diaz, Kelly Linden & Veli Solyali,2021). The COVID-19 pandemic has disrupted anatomy education in many ways: body donations have been suspended, significantly reducing the risk of receiving bodies infected with COVID-19.

There are several alternatives available. This University has produced twenty pre-recorded videos prepared in the anatomy laboratory during the COVID-19 pandemic. These cadaveric tissues were discussed live through interactive tutorials, replacing face-to-face anatomy teaching. 3D anatomy models were provided to students, and they received good feedback from students and academic staff.

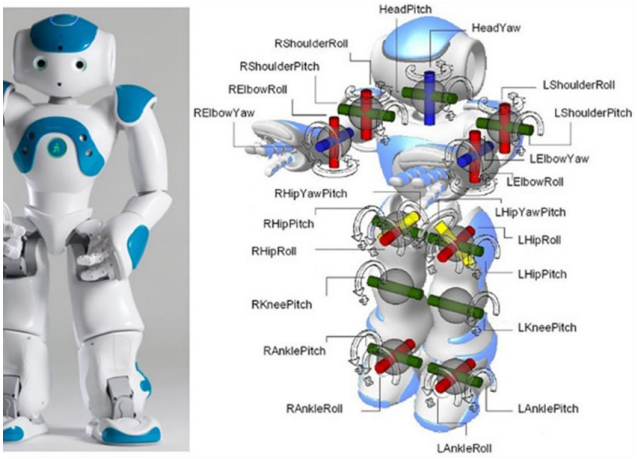
Through hyperlink video presentations, web-based learning and computer-based educational programs were created in virtual classrooms. (Apurba Patra, Adil Asghar, Priti, Chaudhary, Kumar Satish Ravi, 2022).

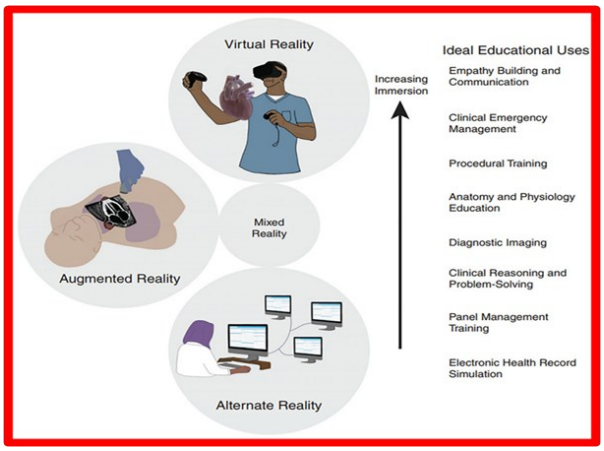


Anatomy Studio

Humanoid robots

This humanoid robot was created by a company named Aldebaran NAO V5. Aldebaran Robotics, a French robotics company headquartered in Paris, involves cloud technology, flipped classrooms and 3D stereoscopy instructional videos. It involves virtual dissection on pre-dissected plasticised specimens and a virtual 3D body system.





Imaging modalities and synthetic cadavers were fitted with ultrasound probes for better visualisation. These probes were to visualise the internal anatomy, including the gut.

Anatomage Table

The Anatomage Table allows students and faculty to access anatomical information previously inaccessible. With a fully interactive, multitouch screen, one can dissect the body, move through layers of tissue, or use a virtual knife to cut away and see the structures inside. We can look at the body with different visualisations, such as opaque hard tissue or an X-ray. The Anatomage Table, invented here by Dr Paul Brown, is a breakthrough in visualisation and interactivity, enhances students' understanding of anatomy, both in general and in clinical concepts, and allows students to explore the body like never before.

Virtual Reality

Dr. Paul Brown's early experiments in VR ultimately led to an iOS/Android app that was VR-enabled for use with cardboard viewers. Produced with Stanford Health Care and former Clinical Anatomy staff, the app allowed users to take brief tours around different body parts. It was provided to visitors and patients at the Stanford Hospital.

Dr. Brown recently used VR to provide an interactive lab experience while remotely running the Clinical Anatomy Summer Program. Students could meet up in a virtual representation of his dissection lab and view and discuss 3D anatomical models.

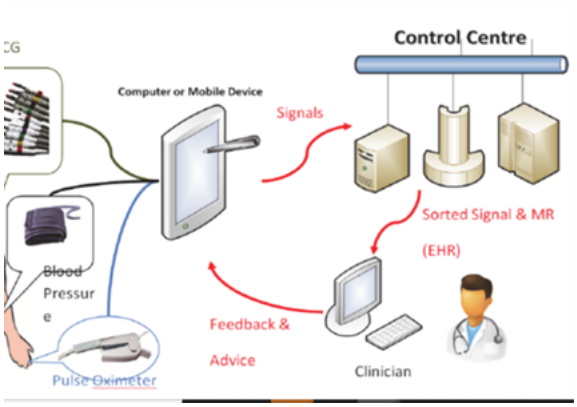
Development of Advanced Technology and Artificial Intelligence

AI-based virtual simulation platform plays a crucial role in the future of medical education. Simulations can provide a realistic environment for learners to practice and refine their clinical skills without harming patients. Medical simulators can replicate real-life scenarios before seeing actual patients. Plagiarism can also be detected. On the other hand, medical literature analysis can also help students navigate and understand complex medical literature, summarising key points and research findings.

Advanced technology and sophisticated equipment will replace clinical skills examinations, such as the Bluetooth-enabled stethoscope with Artificial Intelligence (AI) capability for clinical diagnosis. StethoMe was created by Wojciech Radomski, who was the CEO and Co-Founder.

It is a wireless stethoscope that connects to a smartphone via Bluetooth. It uses a sophisticated array of microphones to isolate the sounds from external audio within a patient's chest.

There is also a concept of the home thermometer, where patients can be at home, not in a hospital. A concept known as "HOUSEPITAL"



Pen-sized ultrasounds will be used in clinical examinations, rendering traditional clinical tests obsolete. The advent of IR.5.0 will usher in remote awake and pinhole surgeries, capsule endoscopies with cameras and biosensors for diagnosing gastrointestinal tract disorders, and targeted genetic engineering-assisted cancer diagnosis. This paradigm shift in healthcare will inevitably influence how we train medical doctors. 2 PhD students from Imperial College London first created this pen-sized ultrasound machine. GE Healthcare, a subsidiary of an American multinational conglomerate, mass-produced this product.

Capsule endoscopy was developed and designed by Gavriel Iddan and gastroenterologist Eitan Scapa in Boston, MA, in the early 1980s. It is a medical procedure used to record internal images of the gastrointestinal tract for disease diagnosis through biopsies, and it releases medication at specific locations of the entire gastrointestinal tract. After a patient swallows the capsule, it passes along the gastrointestinal tract, taking several images per second. It is transmitted wirelessly to an array of receivers connected to a portable recording device.

The Future of Bloom's Taxonomy

The well-established Bloom's taxonomy in medical education and learning objectives will thus be challenged. Traditional teaching and assessment are commonly associated with 'absorption' and recall of facts, names and terminologies. Those with the best recall capabilities will get good grades and are considered 'clever'. The same can no longer be true in the new normalcy. Einstein once said, "Why memorise when you can refer?" This is an excellent indicator that memory should be used for higher-order thinking, not for rote learning and recall of facts. Acquiring knowledge through recalling facts and regurgitating them fluently may now be obsolete as students have instant access to theoretical knowledge on their mobile phones.

The entire profession of a doctor may be in jeopardy as more and more people resort to readily available knowledge on the web. Medical knowledge is, thus, no longer a privilege of doctors. The 'Remember' portion of Bloom's taxonomy may no longer be valid. However, understanding a bodily function is still relevant as this understanding is critical when diseases disrupt the body system.

Students learn better through the visualisation of concepts. Thus, they will better understand a body's function and disruption through animation, augmented or virtual reality, which will be the new normal in medical education. The knowledge acquisition will no longer be through lectures or presentations of PowerPoint slides or even a voiceover PowerPoint because animation will take over. Teachers will thus need to acquire the art of animation of concepts that require special skills.

Therefore, the duration of medical training could be shortened as knowledge could be acquired at students' own pace. Examinations will also be tailor-made to suit students' readiness. The space in the curriculum could then be used to expand experiential learning. This is part of the 'hidden curriculum' and is still a critical test in assessing the quality of a doctor.

The overwhelming challenge is training an empathetic doctor and his ability to empathise and remain compassionate despite these creative technologies. This cannot be done through virtual means. This is only possible through witnessing people's sufferings, smelling the environment and touching the sick. Only through this can a doctor appreciate his patients' pains and join in the celebration and joys of being cured.

Medical education training can thus be revised and revolutionised. The traditional 5-year training may be too long if all the theoretical knowledge can be done at the student's pace. More time should be spent on enhancing the 'hidden curriculum' where students are on-site witnessing illnesses and the nuances in all settings. For example, regular classroom teachings could be suspended when a terrible earthquake or tsunami strikes around the region. Students will be deployed to witness, help and see all the humanitarian disasters that could be seen during their training. The first year could start with total exposure in the wards rather than in the classroom, in the Intensive Care Unit (ICU), talking to the sufferers of diseases and relatives of those suffering. This will significantly impact these young minds, and measures must be taken to mitigate the psychological distress that may happen consequently. Those real-life exposures will strike these young minds positively because this will etch a permanent image as they witness the carers' illness and suffering.

The elements of a hidden curriculum are potent determinants in shaping the persona of medical students. This critical experiential learning will differentiate between a scientifically and technologically advanced doctor and those with empathy, humanity and ethical behaviour.

This will perhaps be the future of medical education.

Conflicts of Interest

The author declare that there are no conflicts of interest related to this study.

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