Efficacy and Benefits of Augmented and Virtual Reality Based Learning during COVID-19

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Introduction

- Traditional medical education typically consists of two years of didactic, lecture-based education (Years 1 and 2), as well as two years of clinical clerkships and patient interactions (Years 3 and 4)
- December 2019: COVID-19 (highly contagious virus) → global pandemic → closure of schools
  - COVID-19 has led to extensive disruption of medical education and training, causing urgency to implement and develop solutions to combat this educational disturbance
  - Considering the COVID-19 pandemic, it is important to be prepared for and adapt to new methods of learning in education
  - Virtual-reality and augmented reality (VR/AR) provide a promising future for the enhancement of medical education
- Objective: This review aims to evaluate the benefits and efficacy of augmented and virtual reality, especially during the COVID-19 pandemic
- Methods: Using several peer-reviewed, randomized trials, we review the advantages of implementing VR/AR into medical school education

**For more information regarding the history of virtual technology, please see the Jansky, Nobori presentation (History and Evolution of Virtual and Augmented Reality in Medical Education) in this symposium*

Efficacy and Benefits

Education

- More intuitive interface fosters **increased motivation to study** compared to traditional book figures[11]
- VR/AR use has **24-hour access** compared to traditional cadaver laboratories
- VR/AR can aid in situations **where cadaveric dissection falls short**[9]
  - VR/AR offer students an **"undo" option**[8]
  - Allows **visualization** of structures too small to see with the naked eye[9]
- VR/AR aid students in **mastering topics sooner** and **mastering them better**[11]
  - Improved long-term retention and alleviation of working memory[11]
  - Enhanced visuospatial learning[11]
- AR can offer medical students a **unique sense of proprioception** and personalization of learning
- VR/AR allow university faculty to **make their own anatomical models** using scans from free databases[4]

Experience and Skills

- VR/AR aid medical students in developing **spatial intelligence**[9]
  - Enhanced ability to mentally convert 2D → 3D images
  - 2D → 3D deepens understanding
- VR can be utilized to **render virtual patient encounters**[6]
  - Comfortability in leading difficult conversations
- VR can allow physician-in-training to **experience clinical encounter from perspective of patient**[6]
  - Empathy towards age-related disease (i.e. Alzheimer's, macular degeneration, high-frequency hearing loss)
- Cost reduction and increased frequency of hospital-wide **triage training**[5]
- Interactive exposure to virtual patients
  - Supplementation of traditional in-person instruction
- Surgeons who used VR simulators made fewer errors and took less time than those who did not[3,7]
- VR simulation provides an objective comparison of performance among trainees[3,7]
- Provides a non-threatening environment for surgeons to improve their performance[3,7]

**For more information regarding the difficulties presented with virtual technology, please see the El-Araby, Kocemba presentation (Limitations of Visualization Technology and Virtual Instruction in Medical Education) in this symposium*

Discussion

- Until recently, VR and AR technologies were too expensive to implement into the educational sector
  - Accessibility on personal devices allows for reduced cost
- COVID-19 pandemic highlighted new challenges in education
  - Medical schools, educators, and students propelled into world of total computerized learning
  - Push needed to implement novel, unfamiliar technologies
  - VR used to solve or confront modern day issues[13]
  - VR allows for specific COVID-19 education and patient care practice in low-risk setting[13]
- VR allows for social-distance based learning[13]
  - Flexible, individualized learning vs. risks of social isolation[10]
- Benefits of continued, safe learning outweigh potential technological challenges of implementing AR/VR into medical education

Conclusion

- During the COVID-19 pandemic, we as a medical community are faced with teaching first year students all skills necessary to become proficient in anatomy, physical exams, and more, virtually
  - The pandemic offers unique opportunity for implementation of new technologies[12]
- However, virtual instruction does not have to stop beyond the COVID-19 crisis
  - Various ways in which virtual technology can teach medical students so-called "soft skills," such as empathy, engaging in difficult conversations, and more
- Because students have traditionally attended universities where passive lecture styles, sub-optimal resources, and limited time for cadaveric dissection have been used to instruct hard-to-master topics, it is time to look towards expanding the learning repertoire of medical students and allow them to personalize their educations

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