Virtual Reality in Medical Education & Training

This field investigation was conducted and is being shared for informational purposes only. For additional details, see the original sources referenced. For discussion, contact Diana Marian, Senior Project Manager at the Digital Education Incubator (dmarian@bu.edu).

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OVERVIEW

1. Summary*
2. Advantages & Outcomes
3. Challenges
4. Application
5. Cost Implications
6. Market Solutions
7. Recommended Next Steps for Higher Ed

*The complete investigation & findings are available in this document.

AT A GLANCE

- Wide use & application potential for individual & group training
- Recommended to complement & augment traditional training methods
- Varied, but typically high hardware & development costs that may decrease over time
- Insufficient data on long-term cost savings & ROI for various setups and scenarios
- More research recommended
- Significant number of vendors & readily available simulations

ADVANTAGES & OUTCOMES

- ✓ Immersive, comprehensive, standardized, hands-on training
- ✓ High level of realism
- ✓ Practice anytime with unlimited repetitions
- ✓ Variety of cases & procedures
- ✓ Immediate, objective feedback
- ✓ Safe environment, no real-life consequences
- ✓ Positive psychological effect on learners (e.g., ↑ self-confidence)
- ✓ Higher accuracy & increased speed in medical practice
- ✓ Decrease in mistakes
- ✓ Improved learning & skills
- ✓ Improved teamwork

CHALLENGES

Oculus awarded ~$100,000 to U-M to build a VR training experience & donated 4 high-tech laptops & 4 sets of Oculus Rifts for this project

- Varied, but typically high setup costs
- "Uncanny valley" - virtual entities closely resembling humans can trigger mental uneasiness for viewers
- Long-term nature & high cost of research studies measuring impact
- Not a replacement for real-life training environment
- Potential increase in training time (per some studies)
- Simulation accuracy can vary
- Scale implications (hardware may quickly become outdated or obsolete)

APPLICATION

- Skills training for various procedures
- Trauma & ER simulation
- Surgical training
- Building communication skills & empathy for the patients
- Understanding of human anatomy
- Preventative medicine, etc.

"Right now [VR] is just another instrument or tool to give younger residents—not older residents because older residents are going to use more cadaver and live surgery—the basic surgical skill sets, such as understanding anatomy, tactile feel and understanding the steps of the procedure."

Dr. Anil Ranawat, orthopedic surgeon, director of the sports medicine fellowship, Hospital for Special Surgery, NYC

APPLICATION EXAMPLES

- Stanford's Neurosurgical Simulation and Virtual Reality Center (Surgical Theater 360 VR)
- Hospital for Special Surgery (Osso VR simulations)
- Northwestern School of Medicine (various VR simulations)
- NYU Grossman School of Medicine (integrates VR and AR in the learning experience)
- Training in pediatric emergency medicine at Children's Hospital Los Angeles (collaboration with Oculus)

COST IMPLICATIONS

✓ Potential to reduce training costs in the long-term

- According to this study, software costs depend on provider and quality of product, but is frequently under one-tenth of the cost of physical simulation independent of provider.
- This study found that the virtual simulation activity had a more favorable cost-utility ratio of US $1.08 versus the mannequin-based simulation activity's US $3.62.
- This study found that, initially, VR is more expensive, but when development costs are extrapolated to repeated training over 3 years, the virtual exercise becomes less expensive while the cost of live exercises remains fixed.

Hardware costs

- $399 per Oculus Quest 2 headset (256 GB)
- $49 carrying case per headset

(SOME) MARKET SOLUTIONS

- Elara
- Arch Virtual
- Osso VR
- Immersive Touch
- Surgical Theater
- Visual Lab 360
- Oxford Medical Simulation
- FundamentalVR
- HealthScholars
- Embodied Labs

- Kognito - specializes in creating one-on-one virtual conversations (use case and more info on simulation research and use cases)
- Immersive Health Group - a BU partner that developed this DL&I-supported pilot project
- Medical Realities
- ScienceSoft

RECOMMENDED NEXT STEPS

- Explore the possibility of vendor partnerships or other cost sharing with institutional stakeholders and/or outside funding for these types of projects
- Determine a feasible long-term approach to VR technology support at the department and/or institutional level
- Investigate existing solutions when possible