

2023

DISASTER PLANNING CONFERENCE

SACRAMENTO

Virtual Reality for Emergency Management Training

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Objectives

As a result of attending this presentation, learners will be able to:

1. List the key principles of adult learning theory
2. Identify the most important aspects of successful emergency management training
3. Describe the challenges inherent to the creation and delivery of effective, realistic, and immersive emergency management training
4. Explain why virtual reality training is particularly well-suited for the delivery of emergency management training to the adult learner
5. List multiple use case scenarios for virtual reality emergency management training

ADULT LEARNING THEORY 101

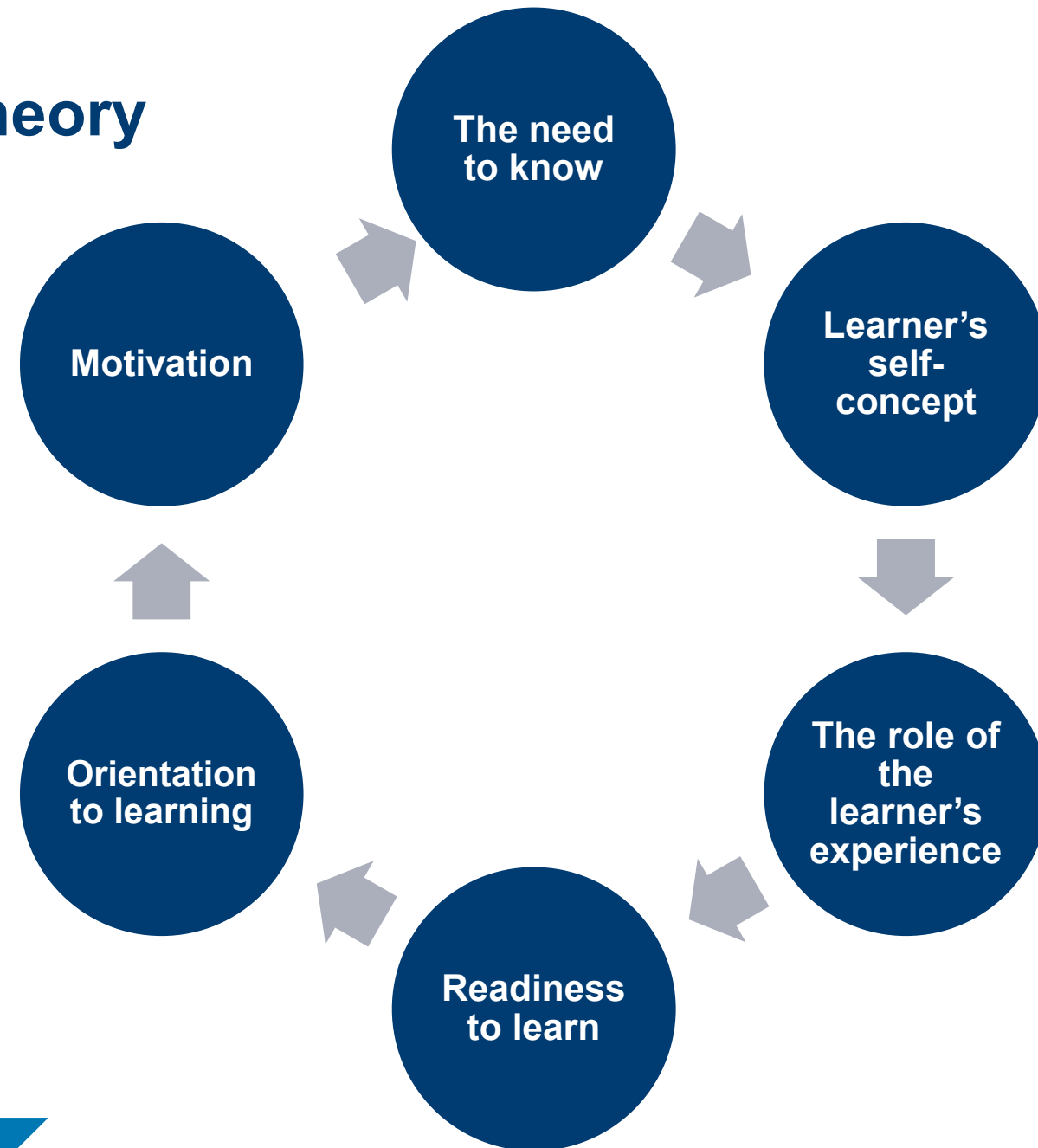


Interactive

Adult Learning Theory is a set of guiding principles that explain how adults learn, in contrast to how children learn.

We are not just big kids....

The Six Principles of Adult Learning Theory



EMERGENCY MANAGEMENT TRAINING

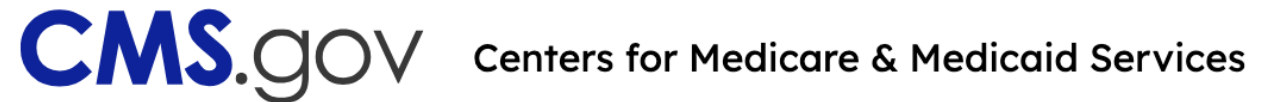
Why do we care?



The Joint Commission and the Centers for Medicare and Medicaid require healthcare entities maintain "**all-hazard**" **emergency preparedness and response capability and capacity**



Effective and realistic training is **essential** to maintain this capability and capacity.





Interactive

What are the most important considerations and characteristics for emergency management training in health care?

Ideally, Emergency Management Training....

Is immersive, experiential, and relevant

Provides the experience without taking the risk

Allows trainees to practice in the contextual environment they will respond in

Promotes interprofessional team interaction, communication, and learning

Trains both technical and non-technical skills (triage, ICS, decision-making)

Gives learners a sense of competence/mastery

Provides consistent, reliable, standardized training opportunities

Is portable, flexible, scalable, and trackable

Doesn't break the bank or the participants

Minimizes disruption to patient care operations

Facilitates assessment of emergency management planning and response

When Worlds Collide...



Pacific

DRIVE-IN THEATRES

CHILDREN
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Baseline

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FIRST R RDINO

UNTOLD EX

the crash of planets
Earth and "Bellus"!

WHEN THE WORLD COL

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pletely inundated!

desperate getaway
flight from Earth!

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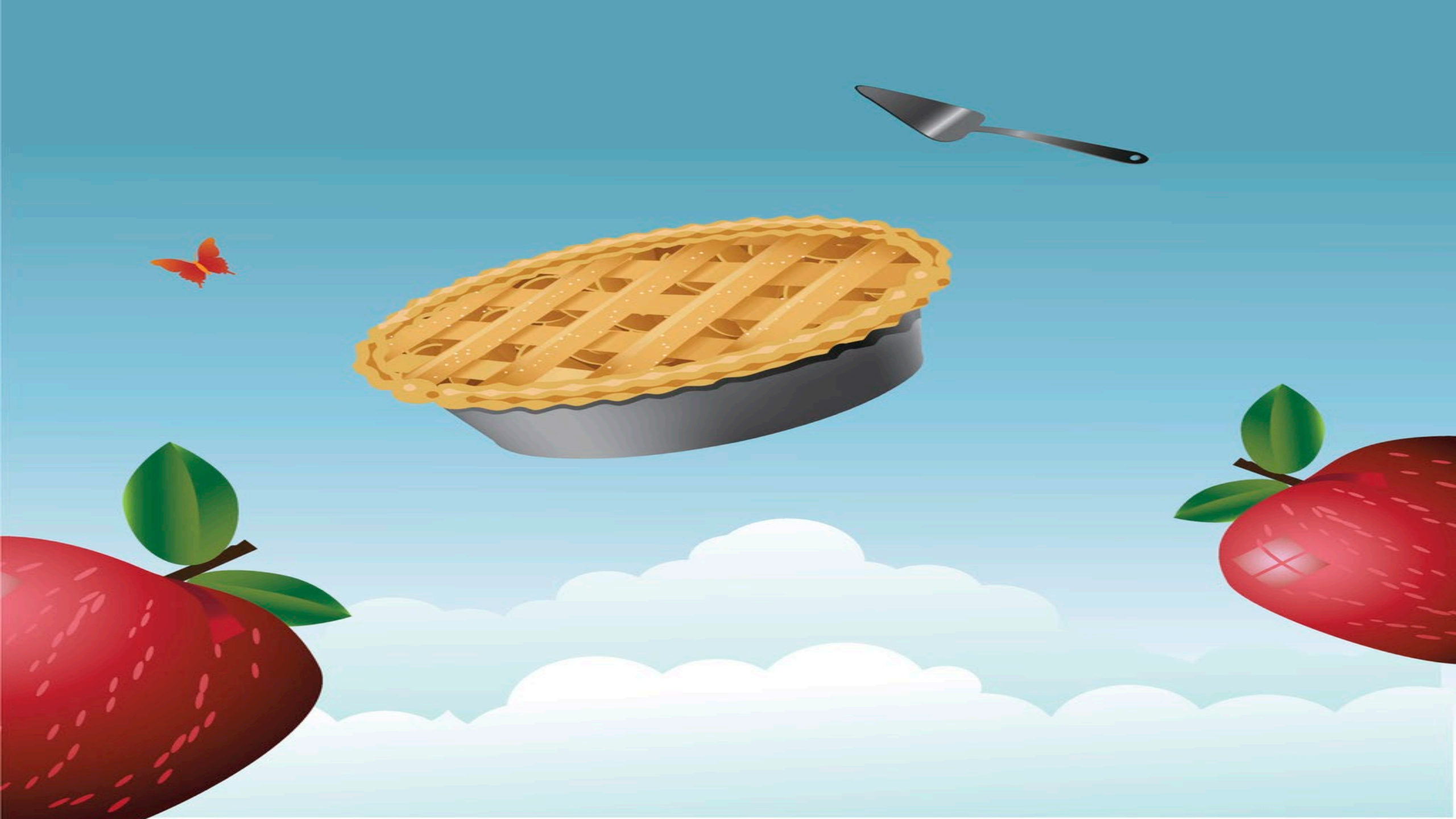
The Reality





Interactive

Why is emergency management training in health care so challenging?



VIRTUAL REALITY



How many of you have been in a virtual reality headset?

How many of you have used virtual reality for emergency management training?



vir·tu·al re·al·i·ty

/,vərCH(əw)əl rē' alədē/

noun

the computer-generated simulation of a three-dimensional image or environment that can be interacted with in a seemingly real or physical way by a person using special electronic equipment, such as a helmet with a screen inside or gloves fitted with sensors.





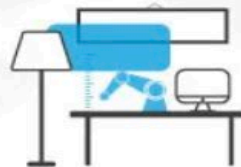
Extended Reality (XR)

Umbrella term that encompasses any sort of technology that alters reality by adding *digital elements* to the *physical or real-world environment* by any extent



Augmented Reality (AR)

Digital layer over physical elements



Mixed Reality (MR)

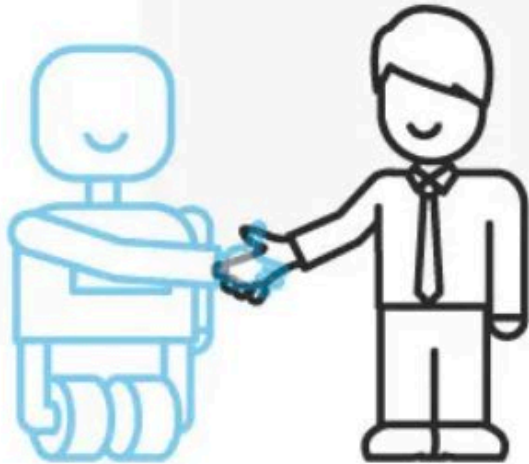
Digital elements can interact with physical elements



Virtual Reality (VR)

Fully-immersive **digital** environment

AR vs. MR vs. VR



Augmented Reality (AR)

a view of the physical world with an **overlay** of **digital** elements



Mixed Reality (MR)

a view of the physical world with an overlay of **digital** elements where physical and digital elements can **interact**



Virtual Reality (VR)

a **fully-immersive digital** environment

WHY VIRTUAL REALITY FOR EMERGENCY MANAGEMENT TRAINING?

Why VR for Emergency Management Training?

Virtual reality provides a safe and effective training solution for mission-critical training that requires immersive hands-on training but is difficult, dangerous, and/or expensive to reproduce in a training environment.



Why VR for Emergency Management Training (cont.)



Interactive

Is immersive, experiential, and relevant

Provides the experience without taking the risk

Allows trainees to practice in the contextual environment they will respond in

Promotes interprofessional team interaction, communication, and learning

Trains both technical and non-technical skills (triage, ICS, decision-making)

Gives learners a sense of competence/mastery

Provides consistent, reliable, standardized training opportunities

Is portable, flexible, scalable, and trackable

Doesn't break the bank or the participants

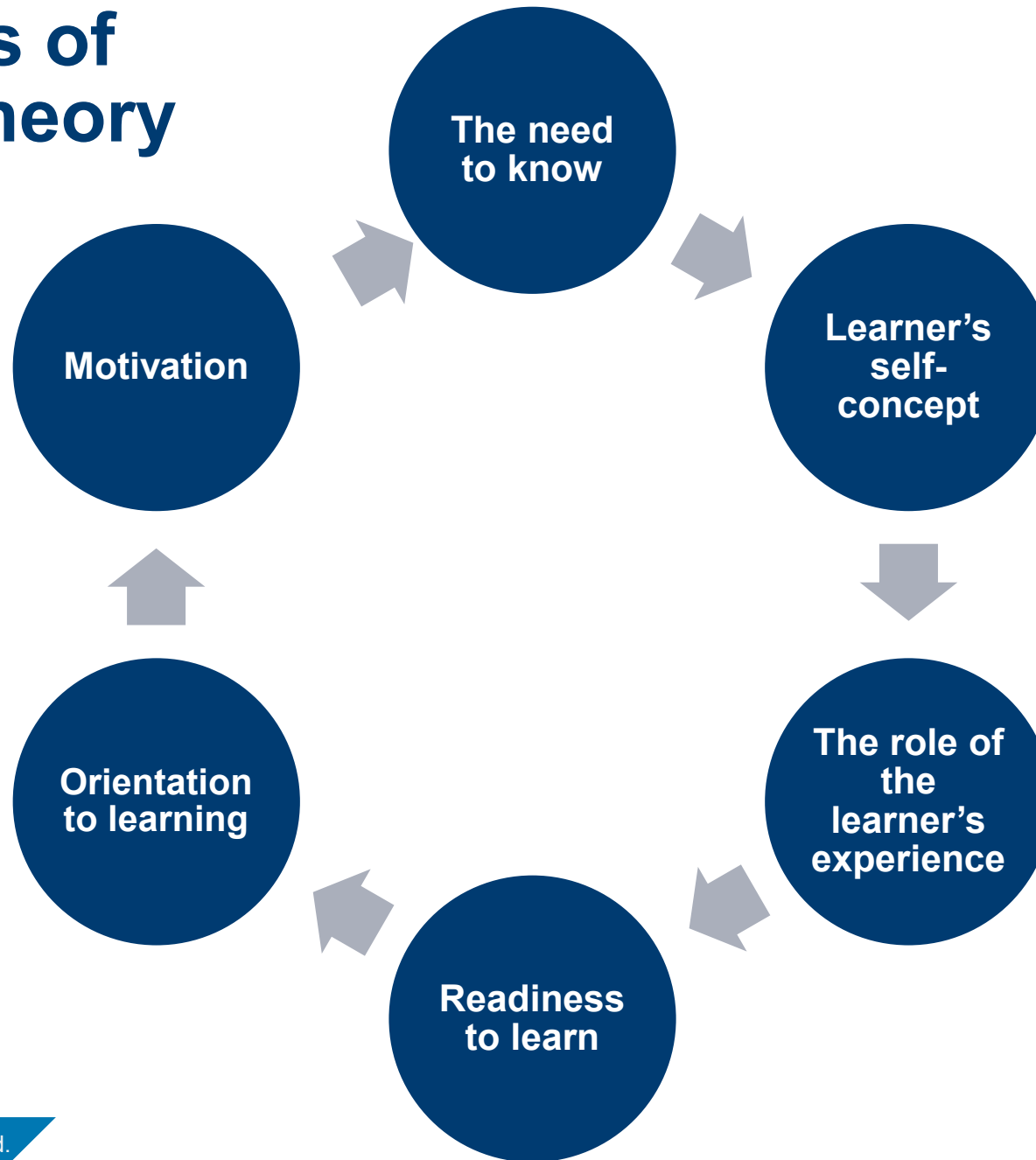
Minimizes disruption to patient care operations

Facilitates assessment of emergency management planning and response

Provides Built-In Analytical Tools for Performance Assessment

VR headsets can be leveraged in other healthcare training areas

The Six Principles of Adult Learning Theory





When thinking of VR for emergency management training -- what training topics come to mind?

Virtual Reality for Emergency Management Training (cont.)

Potential EM Training Topics include:

Mass Casualty Surge

Chemical/Biological/Radiological Events

Hospital Evacuation

Active Shooter Response

And so on.....



THREE MINUTE LIT REVIEW: VIRTUAL REALITY FOR EMERGENCY MANAGEMENT TRAINING

VR for Emergency Management Training (cont.)

Three major capabilities of virtual reality simulation were identified:

- (1) Realistic simulation of the clinical environment and medical practices related to different disaster scenarios
- (2) Provide learning effects -- increased confidence and enhanced knowledge acquisition
- (3) Enables cost-effective implementation of training programs

[Journal List](#) > [J Med Internet Res](#) > [v.24\(1\); 2022 Jan](#) > PMC8838598



Journal of Medical Internet Research ISSN 1438-8871
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[J Med Internet Res](#). 2022 Jan; 24(1): e30600. PMCID: PMC883
Published online 2022 Jan 28. doi: [10.2196/30600](https://doi.org/10.2196/30600) PMID: [3508](https://pubmed.ncbi.nlm.nih.gov/35081211/)

Virtual Reality Simulation for Disaster Preparedness Training in Hospitals: Integrated Review

Monitoring Editor: Rita Kukafka

Reviewed by Fatemeh Ghezelbash, Radu Ciorap, Robert Lundin, and AnirudhNandakumar Joshi

[Younhyun Jung](#), DPhil^{ORCID}

VR for Emergency Management Training (cont.)

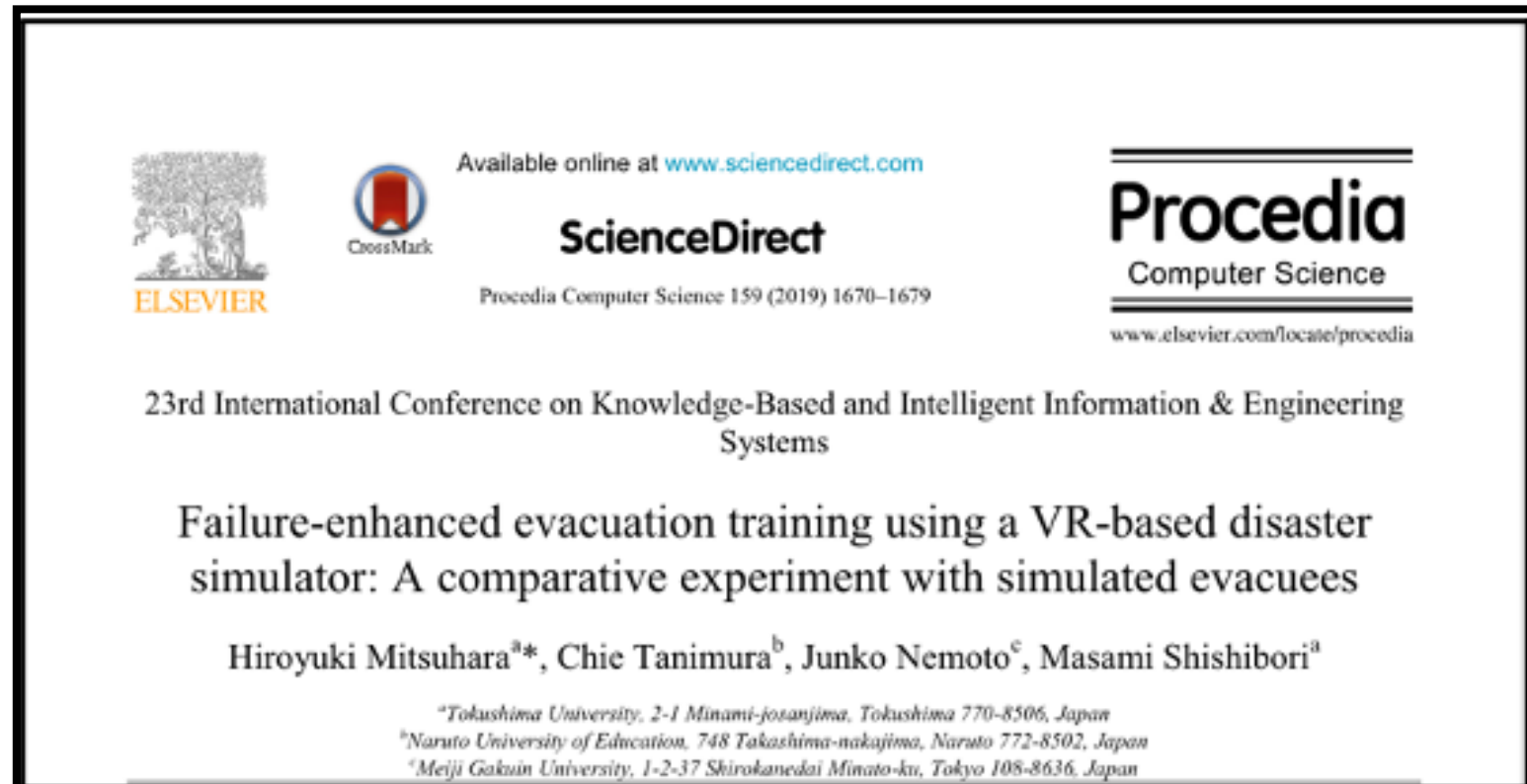
The findings presented in this paper provide a synthetic and critical review of state-of-the-art VR/AR applications for emergency management in the built environment and facilitate further advancements in both research and practice in this area.



VR for Emergency Management Training (cont.)

Conclusion:

Results indicated that failure-enhanced VR disaster simulator evacuation training can successfully improve the training effect.



Simulation in Healthcare

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REVIEW ARTICLE

Virtual Reality Training in Disaster Medicine A Systematic Review of the Literature

Brown, Natasha MD, MS; Margus, Colton MD; Hart, Alexander MD; Sarin, Ritu MD; Hertelendy, Attila PhD; Ciottone, Gregory MD

[Author Information](#) ☺

Simulation in Healthcare: The Journal of the Society for Simulation in Healthcare 18(4):p 255-261, August 2023. | DOI: 10.1097/SIH.0000000000000675

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VR for Emergency Management Training (cont.)

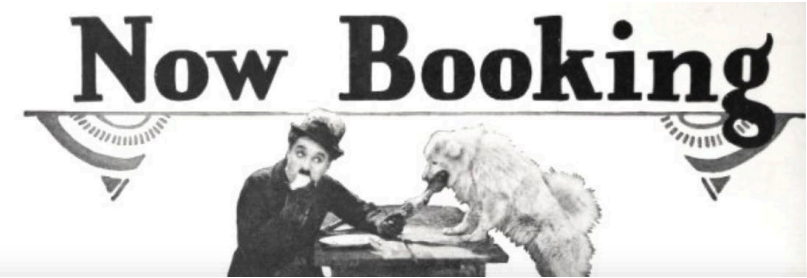
Conclusions

- VR and AR are successful training methods to teach cognitive and technical disaster management skills
- Virtual simulation acceptable and enjoyable for trainees
- VR and AR provide socially distanced training alternatives
- Drawbacks include initial costs and unfamiliarity with technology

Next Steps to Assess VR and Emergency Management Training

- Standardization/creation of uniformity in emergency management training
- Systematic review and meta-analysis of all disaster simulation types

What's Next?



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How to Get Started With VR

Learn VR basics

Explore the space!

Consider conferences and association memberships

[American Medical Extended Reality Association \(https://AMXRA.org\)](https://AMXRA.org)

[International Virtual Reality and Healthcare Association \(https://IVRHA.org\)](https://IVRHA.org)

How to get Started With VR for Training

Establish your use case – what does VR bring compared to traditional training?

Construct your training as always

- Objectives
- Content
- Evaluation

Recognize VR-specific challenges

- Equipment – Headsets, graphics computer
- VR technology learning curve

Additional Considerations

Information Security

- Organizational internet firewall
- Learner training data
- Proprietary information, workflows, etc.

Potential Solutions

- Mobile hotspot
- Generic logins for learners
- Non-Disclosure Agreement (NDA)

Do your homework – not all that glitters....

Questions?



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Thank You

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References

Hsu EB, Li Y, Bayram JD, Levinson D, Yang S, Monahan C. State of virtual reality- based disaster preparedness and response training. PLoS Curr. 2013 Apr

Jung Y. Virtual Reality Simulation for Disaster Preparedness Training in Hospitals: Integrated Review. J Med Internet Res. 2022 Jan 28;24(1)

Kleinert R, Wahba R, Chang DH, Plum P, Hölscher AH, Stippel DL. 3D immersive patient simulators and their impact on learning success: a thematic review. J Med Internet Res. 2015 Apr 8;17(4):e91. doi: 10.2196/jmir.3492. PMID: 25858862; PMCID: PMC4407019.

Foronda CL, Fernandez-Burgos M, Nadeau C, Kelley CN, Henry MN. Virtual Simulation in Nursing Education: A Systematic Review Spanning 1996 to 2018. Simul Healthc. 2020 Feb;15(1):46-54. doi: 10.1097/SIH.0000000000000411. PMID: 32028447.

References

Jallad ST, Işık B. The effectiveness of virtual reality simulation as learning strategy in the acquisition of medical skills in nursing education: a systematic review. *Ir J Med Sci.* 2022 Jun;191(3):1407-1426. doi: 10.1007/s11845-021-02695-z. Epub 2021 Jul 5. PMID: 34227032.

Haerling KA. Cost-Utility Analysis of Virtual and Mannequin-Based Simulation. *Simul Healthc.* 2018 Feb;13(1):33-40. doi: 10.1097/SIH.0000000000000280. PMID: 29373382.

Kyaw BM, Saxena N, Posadzki P, Vseteckova J, Nikolaou CK, George PP, Divakar U, Masiello I, Kononowicz AA, Zary N, Tudor Car L. Virtual Reality for Health Professions Education: Systematic Review and Meta-Analysis by the Digital Health Education Collaboration. *J Med Internet Res.* 2019 Jan 22;21(1):e12959. doi: 10.2196/12959. PMID: 30668519; PMCID: PMC6362387.

Padilha JM, Machado PP, Ribeiro A, Ramos J, Costa P
Clinical Virtual Simulation in Nursing Education: Randomized Controlled Trial, *J Med Internet Res* 2019;21(3):e11529
doi: [10.2196/11529](https://doi.org/10.2196/11529) PMID: [30882355](https://pubmed.ncbi.nlm.nih.gov/30882355/) PMCID: [6447149](https://pubmed.ncbi.nlm.nih.gov/6447149/)

References

Logeswaran A, Munsch C, Chong YJ, Ralph N, McCrossnan J. The role of extended reality technology in healthcare education: Towards a learner-centred approach. *Future Healthc J*. 2021 Mar;8(1):e79-e84. doi: 10.7861/fhj.2020-0112. PMID: 33791482; PMCID: PMC8004346.

Harrington CM, Kavanagh DO, Quinlan JF, Ryan D, Dicker P, O'Keeffe D, Traynor O, Tierney S. Development and evaluation of a trauma decision-making simulator in Oculus virtual reality. *Am J Surg*. 2018 Jan;215(1):42-47. doi: 10.1016/j.amjsurg.2017.02.011. Epub 2017 Feb 10. PMID: 28262203.

Creutzfeldt J, Hedman L, Felländer-Tsai L. Cardiopulmonary Resuscitation Training by Avatars: A Qualitative Study of Medical Students' Experiences Using a Multiplayer Virtual World. *JMIR Serious Games*. 2016 Dec 16;4(2):e22. doi: 10.2196/games.6448. PMID: 27986645; PMCID: PMC5203677.

Maytin M, Daily TP, Carillo RG. Virtual reality lead extraction as a method for training new physicians: a pilot study. *Pacing Clin Electrophysiol*. 2015 Mar;38(3):319-25. doi: 10.1111/pace.12546. Epub 2014 Dec 12. PMID: 25494952.

References

Gutiérrez F, Pierce J, Vergara VM, Coulter R, Saland L, Caudell TP, Goldsmith TE, Alverson DC. The effect of degree of immersion upon learning performance in virtual reality simulations for medical education. *Stud Health Technol Inform.* 2007;125:155-60. PMID: 17377256.

Makowski D, Sperduti M, Nicolas S, Piolino P. "Being there" and remembering it: Presence improves memory encoding. *Conscious Cogn.* 2017 Aug;53:194-202. doi: 10.1016/j.concog.2017.06.015. Epub 2017 Jul 1. PMID: 28676191.

Hiroyuki Mitsuhashi, Chie Tanimura, Junko Nemoto, Masami Shishibori. Failure-enhanced evacuation training using a VR-based disaster simulator: A comparative experiment with simulated evacuees, *Procedia Computer Science*, Volume 159, 2019, Pages 1670-1679, ISSN 1877-0509, <https://doi.org/10.1016/j.procs.2019.09.337>.

References

Yiqing Zhu, Nan Li, Virtual and augmented reality technologies for emergency management in the built environments: A state-of-the-art review, *Journal of Safety Science and Resilience*, Volume 2, Issue 1, 2021, Pages 1-10, ISSN 2666-4496, <https://doi.org/10.1016/j.jnlssr.2020.11.004>.
(<https://www.sciencedirect.com/science/article/pii/S266644962030030X>)

Bracq MS, Michinov E, Jannin P. Virtual Reality Simulation in Nontechnical Skills Training for Healthcare Professionals: A Systematic Review. *Simul Healthc*. 2019 Jun;14(3):188-194. doi: 10.1097/SIH.0000000000000347. PMID: 30601464.

Samadbeik M, Yaaghobi D, Bastani P, Abhari S, Rezaee R, Garavand A. The Applications of Virtual Reality Technology in Medical Groups Teaching. *J Adv Med Educ Prof*. 2018 Jul;6(3):123-129. PMID: 30013996; PMCID: PMC6039818.

Pottle J. Virtual reality and the transformation of medical education. *Future Healthc J*. 2019 Oct;6(3):181-185. doi: 10.7861/fhj.2019-0036. PMID: 31660522; PMCID: PMC6798020.

References

Khanal Shishir, Medasetti Uma Shankar, Mashal Mustafa, Savage Bruce, Khadka Rajiv, Virtual and Augmented Reality in the Disaster Management Technology: A Literature Review of the Past 11 years, *Frontiers in Virtual Reality*, Volume 3, 2022, <https://www.frontiersin.org/articles/10.3389/frvir.2022.843195/full>

Brown N, Margus C, Hart A, Sarin R, Hertelendy A, Ciottone G. Virtual Reality Training in Disaster Medicine: A Systematic Review of the Literature. *Simul Healthc*. 2023 Aug 1;18(4):255-261. doi: 10.1097/SIH.0000000000000675. Epub 2022 Jun 14. PMID: 35696131.