Virtual Reality CPR

Federico Semeraro, MD, FERC
U.O.C. Rianimazione ed Emergenza Territoriale, Ospedale Maggiore Bologna
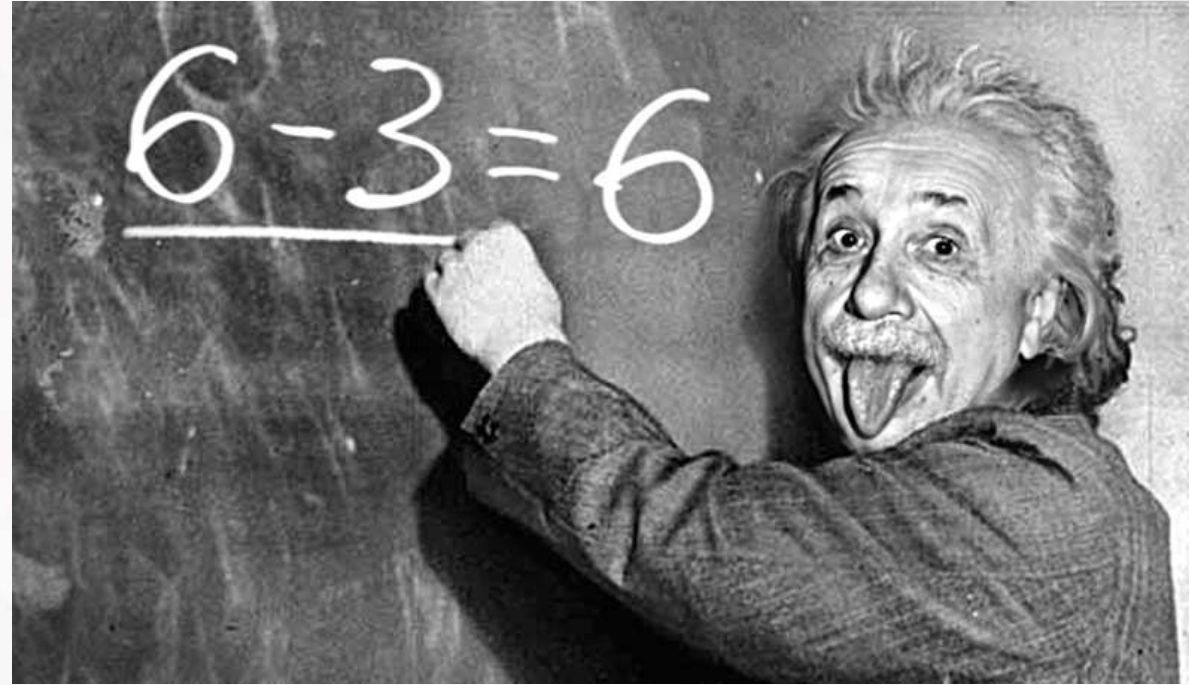
Conflict of Interest

ILCOR Chair Social Media Working Group &BLS Task Force Member
Chair-Elect European Resuscitation Council
Kids Save Lives Leader European Resuscitation Council
EuReCa National Coordinator Italy
Star Wars & Star Trek addicted

Nothing is impossible

"Tutti sanno che una cosa è impossibile da realizzare, finché arriva uno sprovveduto che non lo sa e la inventa."
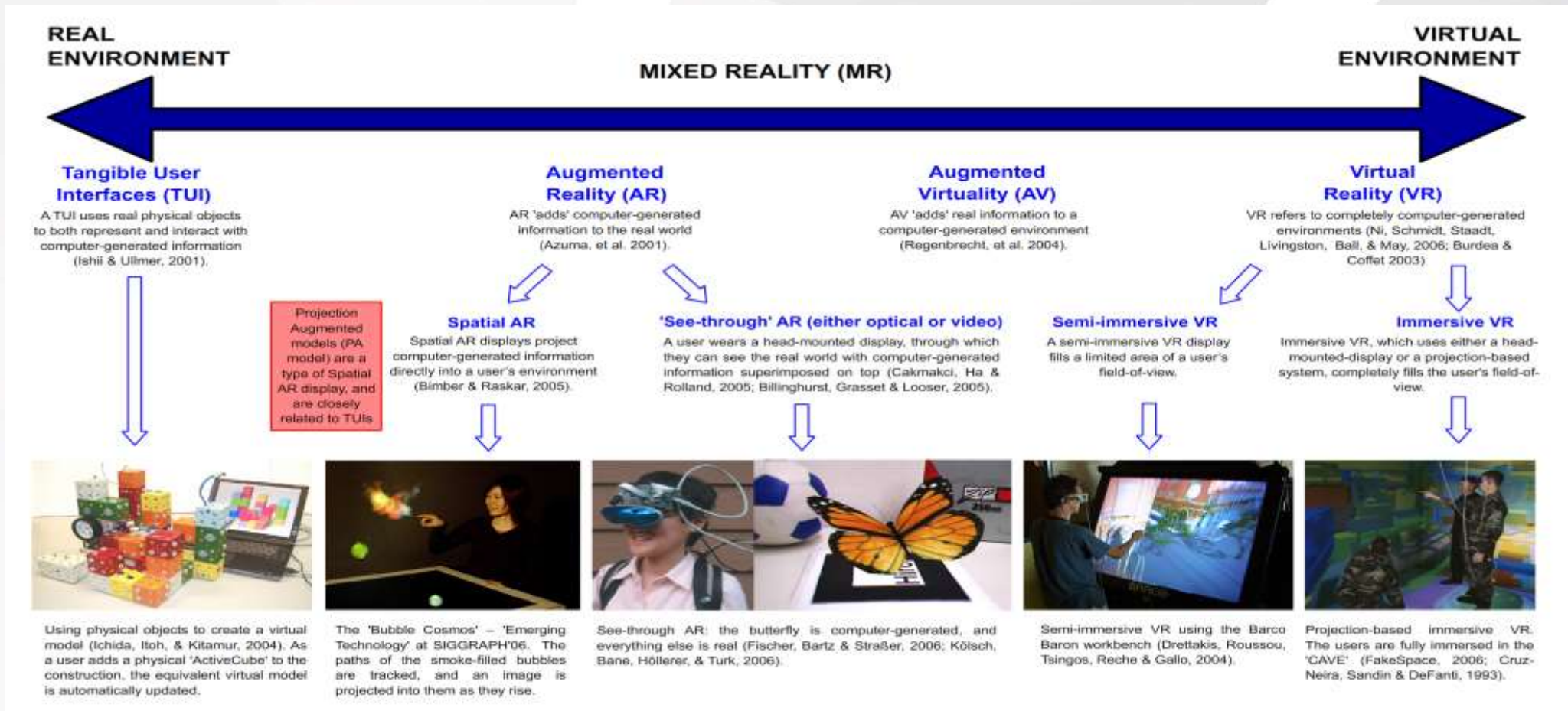
La realtà virtuale è una realtà simulata, un ambiente tridimensionale costruito al computer che può essere esplorato e con cui è possibile interagire usando dispositivi informatici – visori, guanti, auricolari – che proiettano chi li indossa in uno scenario così realistico da sembrare vero.
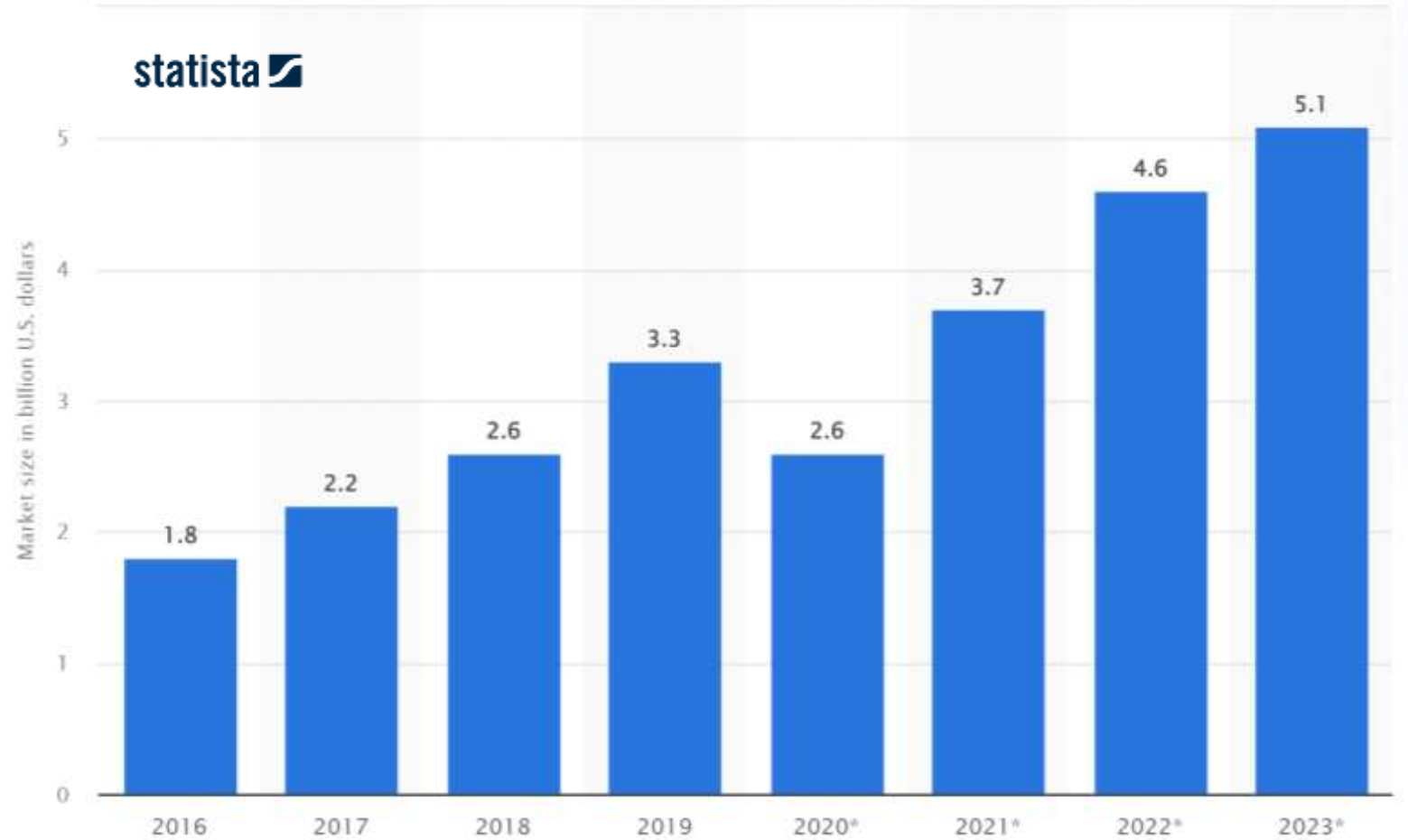
Jaron Lanier, informatico, compositore e saggista statunitense, noto per aver reso popolare la locuzione virtual reality (realtà virtuale, di cui è peraltro considerato un pioniere).

www.jaronlanier.com

REAL ENVIRONMENT ← MIXED REALITY (MR) → VIRTUAL ENVIRONMENT

Tangible User Interfaces (TUI)
A TUI uses real physical objects to both represent and interact with computer-generated information (Ishii & Ullmer, 2001).

Augmented Reality (AR)
AR 'adds' computer-generated information to the real world (Azuma, et al. 2001).

Augmented Virtuality (AV)
AV 'adds' real information to a computer-generated environment (Regenbrecht, et al. 2004).

Virtual Reality (VR)
VR refers to completely computer-generated environments (Ni, Schmidt, Staadt, Livingston, Ball, & May, 2006; Burdea & Coffet 2003)

Projection Augmented models (PA model) are a type of Spatial AR display, and are closely related to TUIs

Spatial AR
Spatial AR displays project computer-generated information directly into a user's environment (Bimber & Raskar, 2005).

'See-through' AR (either optical or video)
A user wears a head-mounted display, through which they can see the real world with computer-generated information superimposed on top (Cakmakci, Ha & Rolland, 2005; Billinghurst, Grasset & Looser, 2005).

Semi-immersive VR
A semi-immersive VR display fills a limited area of a user's field-of-view.

Immersive VR
Immersive VR, which uses either a head-mounted-display or a projection-based system, completely fills the user's field-of-view.

Using physical objects to create a virtual model (Ichida, Itoh, & Kitamur, 2004). As a user adds a physical 'ActiveCube' to the construction, the equivalent virtual model is automatically updated.

The 'Bubble Cosmos' – 'Emerging Technology' at SIGGRAPH'06. The paths of the smoke-filled bubbles are tracked, and an image is projected into them as they rise.

See-through AR: the butterfly is computer-generated, and everything else is real (Fischer, Bartz & Straßer, 2006; Kölsch, Bane, Höllerer, & Turk, 2006).

Semi-immersive VR using the Barco Baron workbench (Drettakis, Roussou, Tsingos, Reche & Gallo, 2004).

Projection-based immersive VR. The users are fully immersed in the 'CAVE' (FakeSpace, 2006; Cruz-Neira, Sandin & DeFanti, 1993).
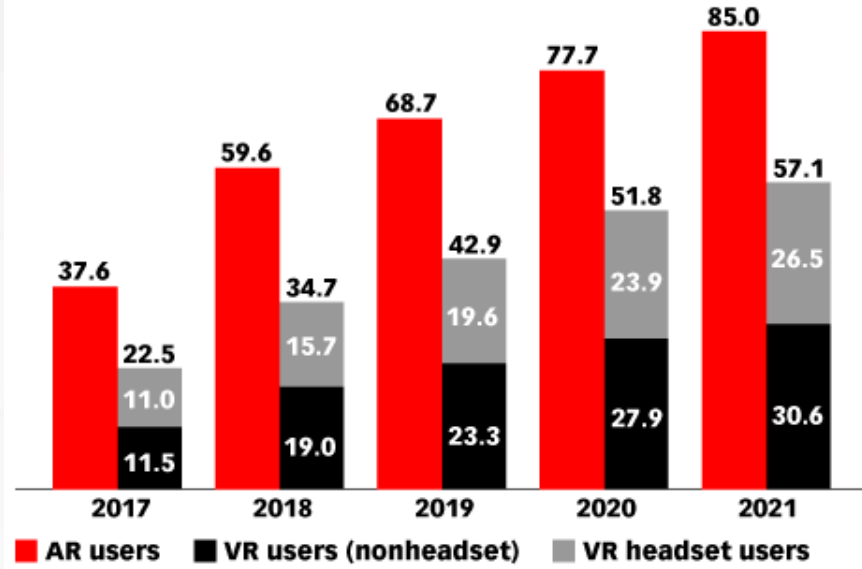
Consumer virtual reality (VR) hardware and software
market revenue worldwide
from 2016 to 2023

US Virtual Reality and Augmented Reality Users, 2017-2021

millions

	2017	2018	2019	2020	2021
AR users	37.6	59.6	68.7	77.7	85.0
VR headset users	11.0	15.7	19.6	23.9	26.5
VR users (nonheadset)	11.5	19.0	23.3	27.9	30.6

Stacked totals: 22.5, 34.7, 42.9, 51.8, 57.1

■ **AR users**   ■ **VR users (nonheadset)**   ■ **VR headset users**

Note: virtual reality (VR) users are individuals of any age who experience VR content at least once per month via any device; augmented reality (AR) users are individuals of any age who experience AR content at least once per month via any device
Source: eMarketer, March 2019

245839   www.**eMarketer**.com

---

3 Key Virtual Reality Statistics You Must Know

FinancesOnline
REVIEWS FOR BUSINESS

1 What are virtual reality's top adoption barriers?

26% Poor user experience (bulky hardware, technical glitches)

24% Content offerings (lack of quality content, availability)

14% Reluctance by consumers and businesses

13% Regulation and legal risks

12% Financing and investment

10% Cost to consumers

2 In which industries is VR most useful?

- 61% gaming
- 41% healthcare and medical devices
- 41% education
- 23% manufacturing and automotive
- 21% movies and television
- 20% workforce development
- 16% marketing and advertising
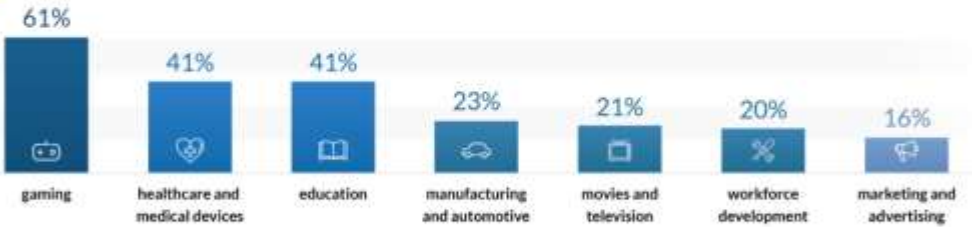
3 What are the top workforce development benefits of VR?

provide information in real time	49%
facilitate training and mirroring real-life experiences	49%
enhance creativity in product design and development	48%
enable remote workforce to collaborate in real time	47%
allow users to live out someone else's life experiences	41%
capture novel user data like behavior, eye and gesture tracking	25%
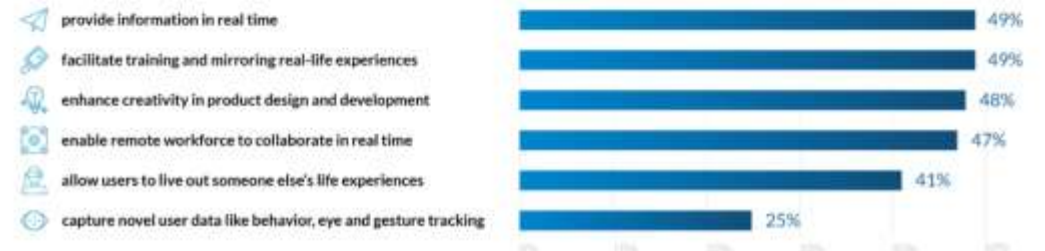
Short communication

Virtual reality enhanced mannequin (VREM) that is well received by resuscitation experts☆

Federico Semeraro[a,*], Antonio Frisoli[b], Massimo Bergamasco[b], Erga L. Cerchiari[a]

[a] Department of Anaesthesia and Intensive Care, Ospedale Maggiore, Bologna, Italy
[b] Percro, Scuola Superiore Sant'Anna, Pisa, Italy

Summary: The objective of this study was to test acceptance of, and interest in, a newly developed proto-type of virtual reality enhanced mannequin (VREM) on a sample of congress attendees who volunteered to participate in the evaluation session and to respond to a specifically designed questionnaire.

Methods: A commercial Laerdal HeartSim 4000 mannequin was developed to integrate virtual reality (VR) technologies with specially developed virtual reality software to increase the immersive perception of emergency scenarios. To evaluate the acceptance of a virtual reality enhanced mannequin (VREM), we presented it to a sample of 39 possible users. Each evaluation session involved one trainee and two instructors with a standardized procedure and scenario: the operator was invited by the instructor to wear the data-gloves and the head mounted display and was briefly introduced to the scope of the simulation. The instructor helped the operator familiarize himself with the environment. After the patient's collapse, the operator was asked to check the patient's clinical conditions and start CPR. Finally, the patient started to recover signs of circulation and the evaluation session was concluded. Each participant was then asked to respond to a questionnaire designed to explore the trainee's perception in the areas of user-friendliness, realism, and interaction/immersion.

Results: Overall, the evaluation of the system was very positive, as was the feeling of immersion and realism of the environment and simulation. Overall, 84.6% of the participants judged the virtual reality experience as interesting and believed that its development could be very useful for healthcare training.

Conclusions: The prototype of the virtual reality enhanced mannequin was well-liked, without interfence by interaction devices, and deserves full technological development and validation in emergency medical training.

Virtual Reality for CPR training: How cool is that?
Dedicated to the "next generation"

Do you believe virtual reality could play a role in the future of training?
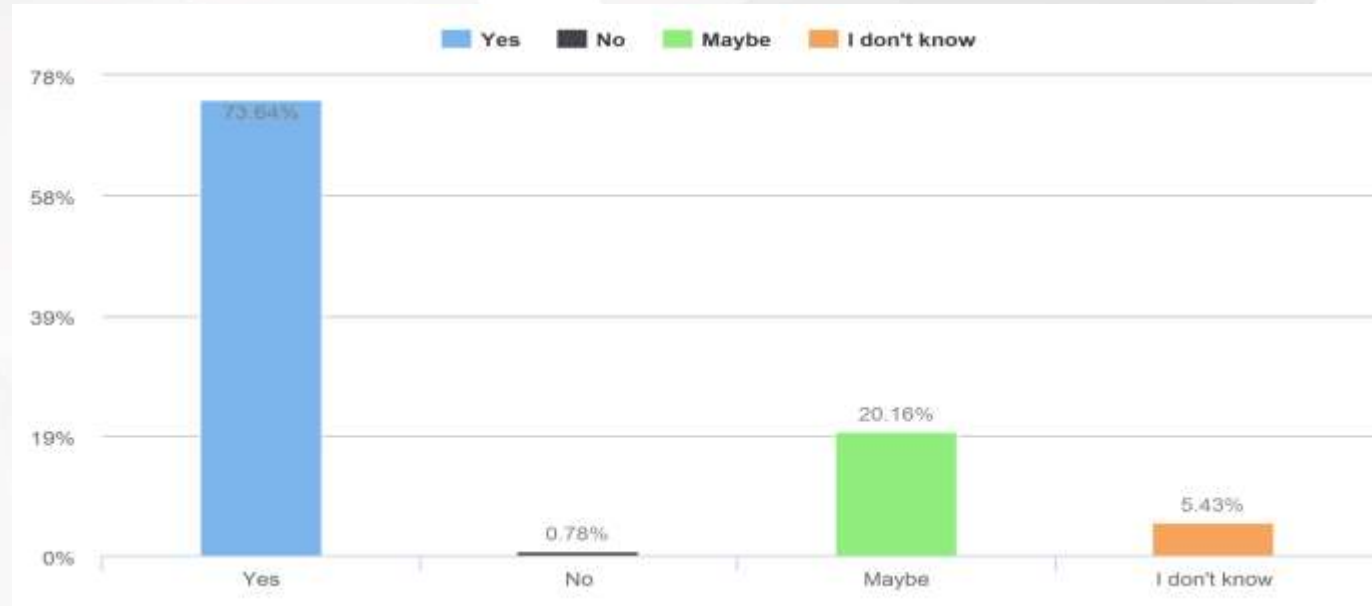
258 responses from 18 countries
Key person in National Resuscitation Council, Educator, Instructors, ERC Research Net Network

Virtual Reality for CPR training: How cool is that? Dedicated to the "next generation".
Semeraro F, Scapigliati A, Ristagno G et al. Resuscitation. 2017 Dec;121:e1-e2

Do you believe virtual reality could works better with some target groups?
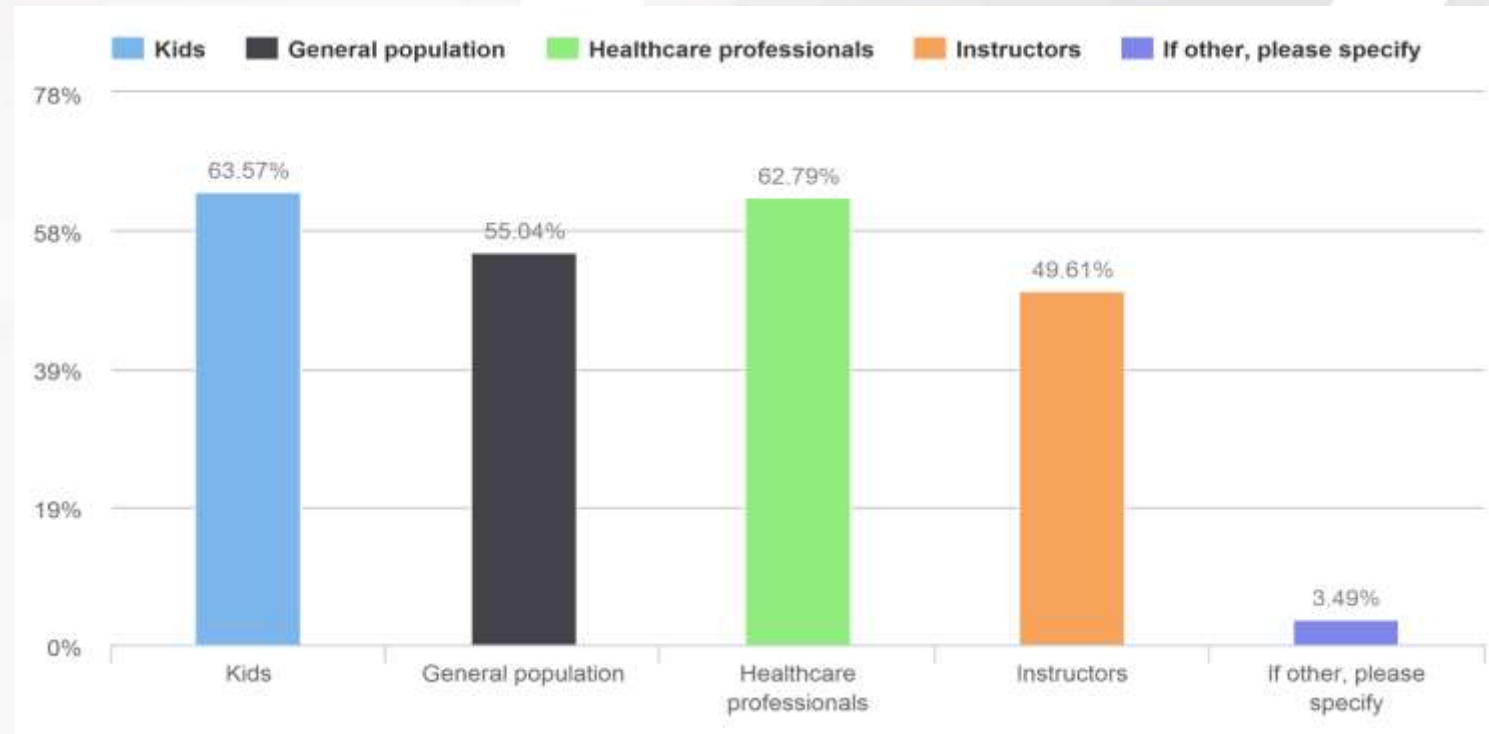
Virtual Reality for CPR training: How cool is that? Dedicated to the "next generation".
Semeraro F, Scapigliati A, Ristagno G et al. Resuscitation. 2017 Dec;121:e1-e2

Ten Years Challenge! #TenYearsChallenge #TenYearChallenge #TenYears
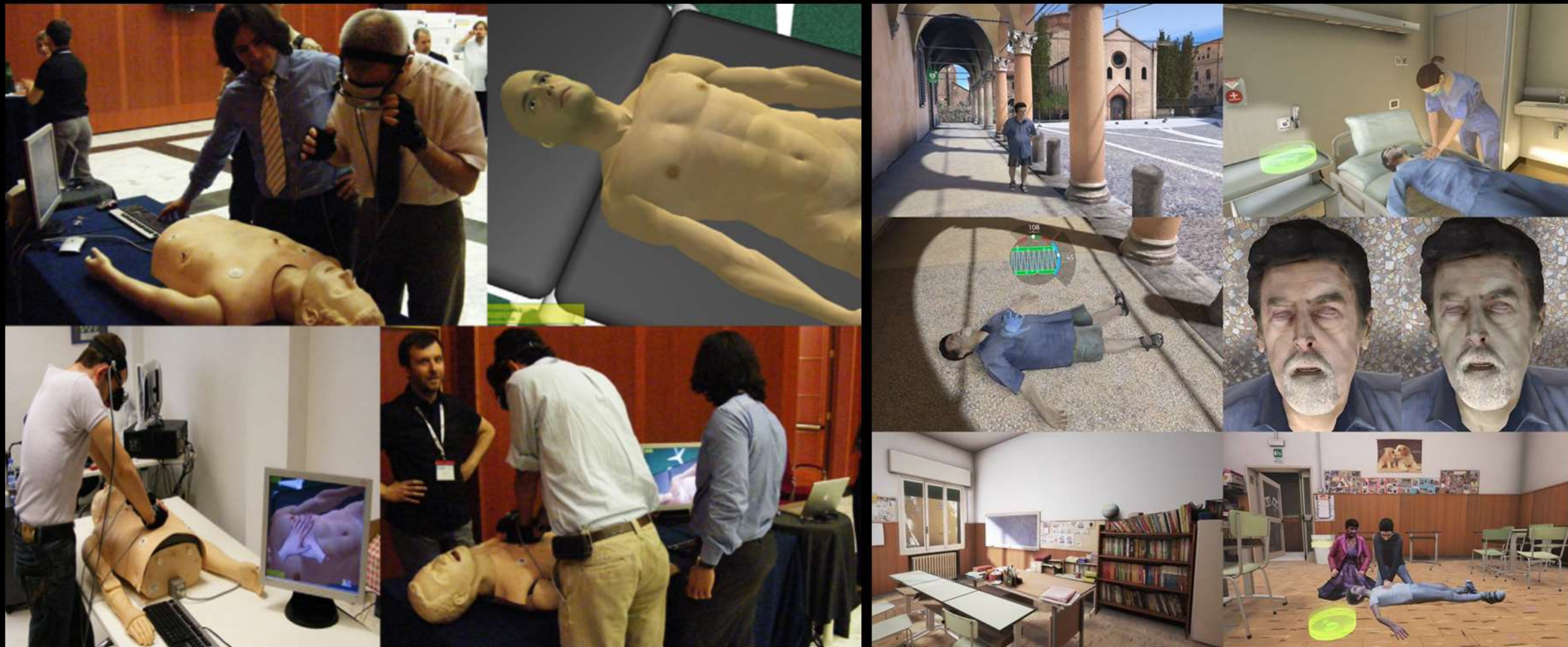
#VirtulReality #VRCPR #SchoolOfCPR #VREM #Relive #IRC

The Lord of the Rings: The Fellowship of the ERC

Giuseppe (Frodo) Ristagno, Andrea (Aragorn) Scapigliati & Federico (Legolas) Semeraro

Studio Evil
VR Development

Gold Sponsor

Silver Sponsor

Bronze Sponsor

VR CPR HTC Vive for Training Center

VR CPR for HTC Vive Personal Edition

VR CPR Oculus Go
School of CPR

Virtual Reality CPR
Italian Resuscitation Council

Arresto cardiaco adulto Extraospedaliero

RCP con sole compressioni e DAE

Location: Piazza Santo Stefano

Virtual Reality CPR
Italian Resuscitation Council

Arresto cardiaco adulto Intraospedaliero

Basic Life Support Defibrillation (BLS-D)

Virtual Reality CPR
Italian Resuscitation Council

Arresto cardiaco Pediatrico Extraospedaliero

**Pediatric
Basic Life Support Defibrillation
(PBLS)**
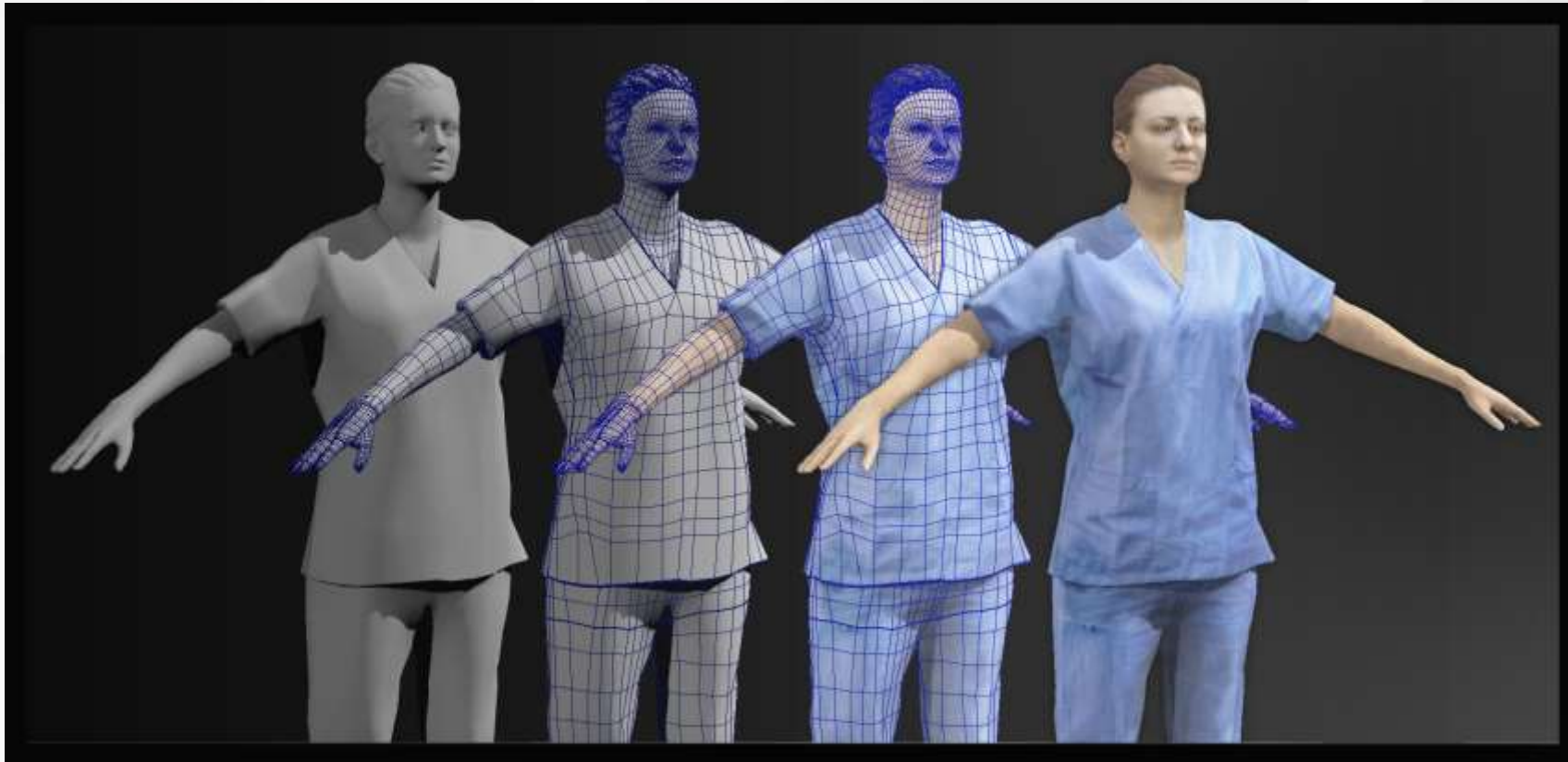
Virtual Reality CPR
Italian Resuscitation Council

Virtual Reality CPR
Italian Resuscitation Council

Festival Tous Engagés #FTE18
Testing in Real life
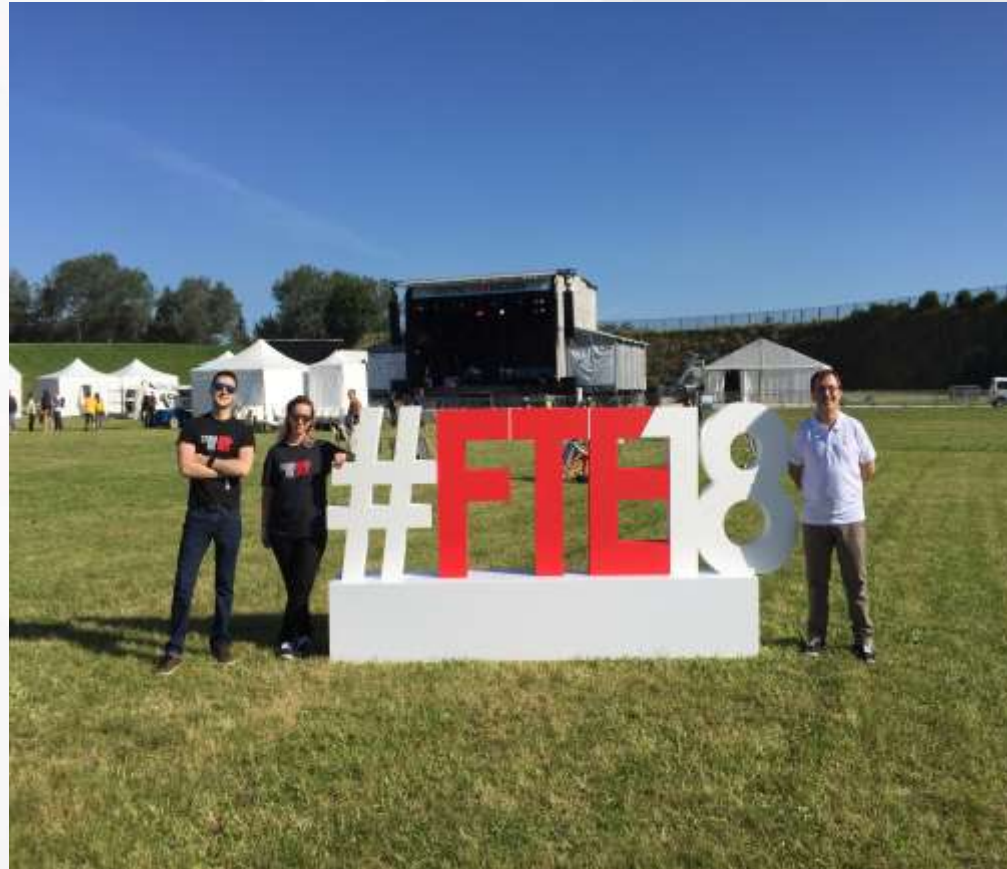
University of Bologna Medical Students Testing in Real life

- The VR CPR was tested in 43 users.

- Medical students at first year of medicine and surgery degree.

- All students were ERC BLS provider from 2018.

- The sample consisted of 25 (58%) male and 18 (42%) women

- Average age of 21±3 years and BMI 22±2.

Virtual reality cardiopulmonary resuscitation (CPR): Comparison with a standard CPR training mannequin. Semeraro F et al. Resuscitation. 2019 Feb;135:234-235.

University of Bologna Medical Students Testing in Real life
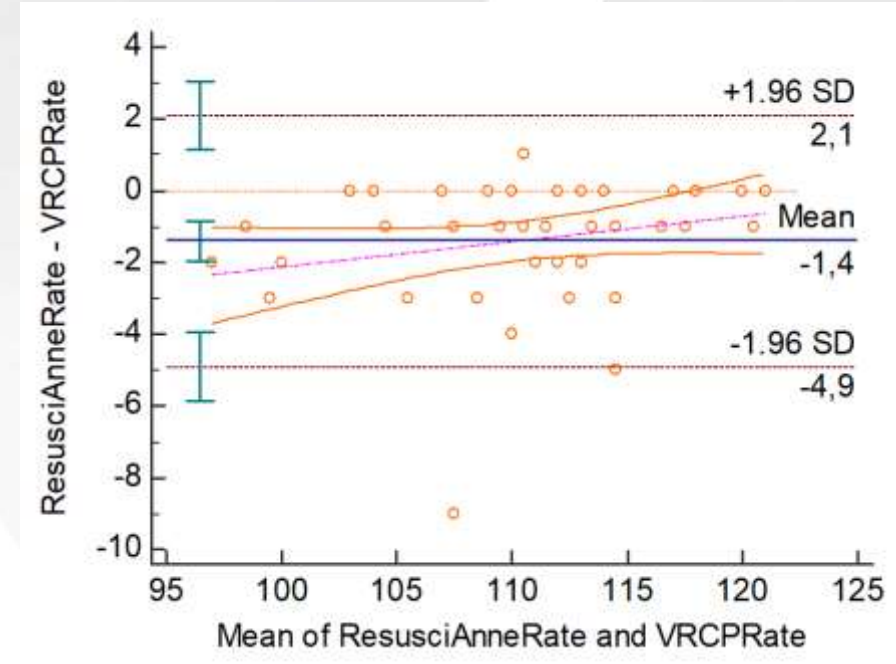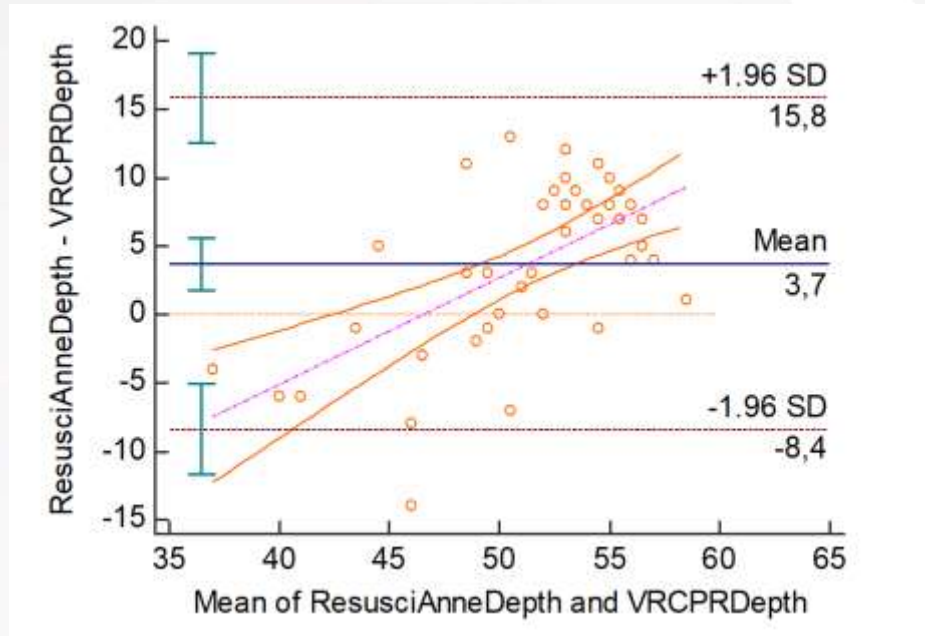
The Bland–Altman plot of chest compression depth and chest compression rate (Resusci Anne vs. VR CPR) in the 43 students performance of 120 s chest compressions only-CPR.

Virtual reality cardiopulmonary resuscitation (CPR): Comparison with a standard CPR training mannequin. Semeraro F et al. Resuscitation. 2019 Feb;135:234-235.

BLS VRQ Pilot Course

Programma

8.00-8.15 Presentazione del Corso

8.15-8.45 Lezione BLS e defibrillazione

8.45-9.00 Dimostrazione BLSD e Quality CPR

9.00-9.20 Valutazione Q-CPR

9.00-10.20 Gruppi (Quality CPR & Virtual Reality)

10.20-10.40 Pausa

10.40-13.00 Gruppi (Quality CPR & Virtual Reality)

12.40-13.00 Valutazione Q-CPR

13.00-13.15 Chiusura Corso

BLS VRQ Pilot Course

BLS VRQ Pilot Course

BLS VRQ Pilot Course

# Back to reality: a new blended pilot course of BLS with VR

Back to reality: A new blended pilot course of Basic Life Support with Virtual Reality.
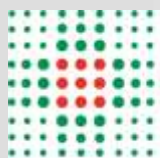Semeraro F et al. Resuscitation. 2019 May;138:18-19.

- BLS VRQ 2022

- VR CPR smarthphones "KIDS SAVE LIVES" 2022

- Research on virtual reality training vs standard training

- VR CPR for Oculus Quest 2 - Fundraising

- Metaverse Facebook

«VR Apps for KIDS SAVE LIVES»
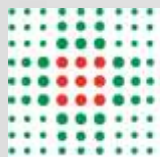
Oculus Quest 2

Metaverse Facebook