

Virtual Reality Flight Simulator Versus a Conventional Flight Simulator Training Device

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8th November 2023



eats2023
C A S C A I S



CESDA
Universitat Rovira i Virgili



- Immersivity
- Smaller size
- Substitute FSTD



- Safety
- Certification

Summary

- What science says about VR in education
- Experiment with 29 student pilots to compare VRFS vs FSTD
- Results
- Conclusions

Virtual Reality can support education

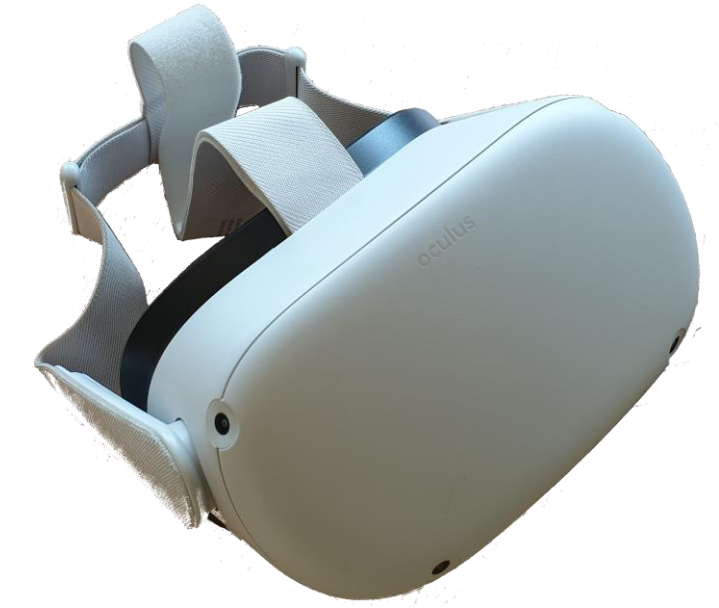
- Students **voluntarily** spent more time in the learning task
(Alhalabi 2016)
- To acquire cognitive, psychomotor and affective **skills**
(Jensen and Konradsen 2018)
- VR is better for **spatial awareness** but classroom teaching is better for **remembering facts**
(Rasheed et al. 2015)



Source: Gerd Altmann on Pixabay

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Virtual Reality is not perfect

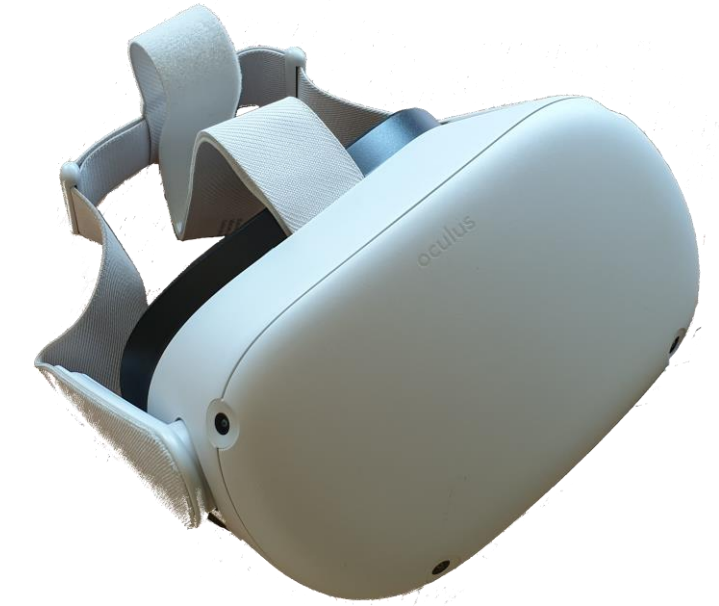
- Graphical rendering can **distract** from the learning task
(Fernandes et al. 2016)
- **Cybersickness** experienced in VR simulation can cause nausea, dizziness and general discomfort
(Chardonnet et al. 2021)
- Novel technologies can be **challenging for teachers**
(Bower et al. 2020)



Source: Tima Miroshnichenko on Pexels

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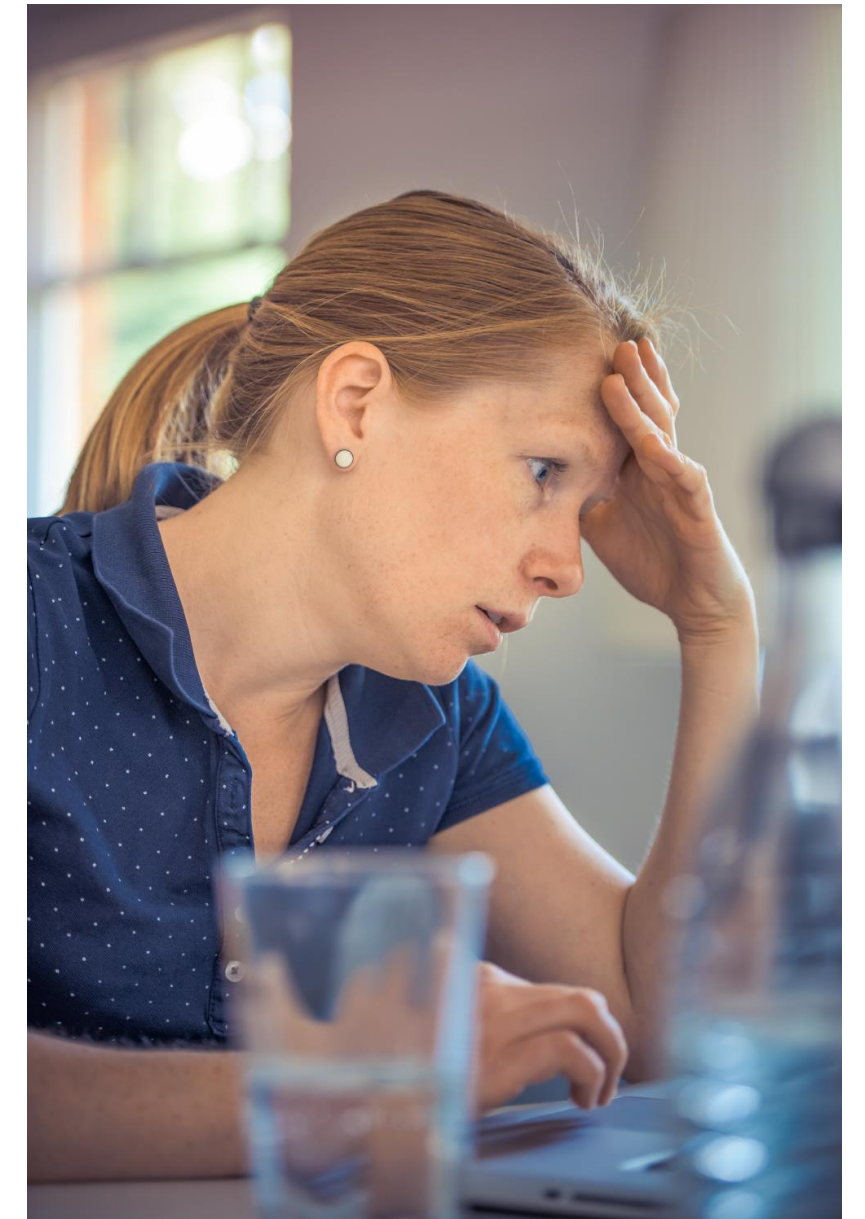
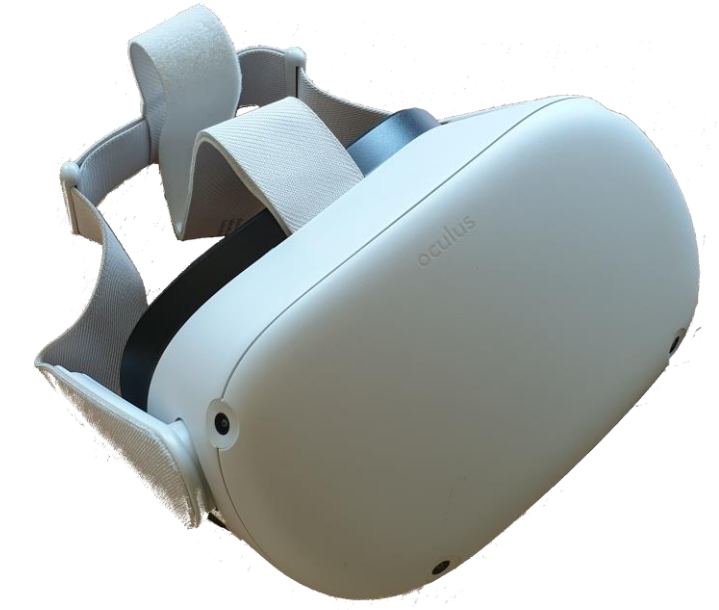
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Source: Mehrpouya H on Unsplash

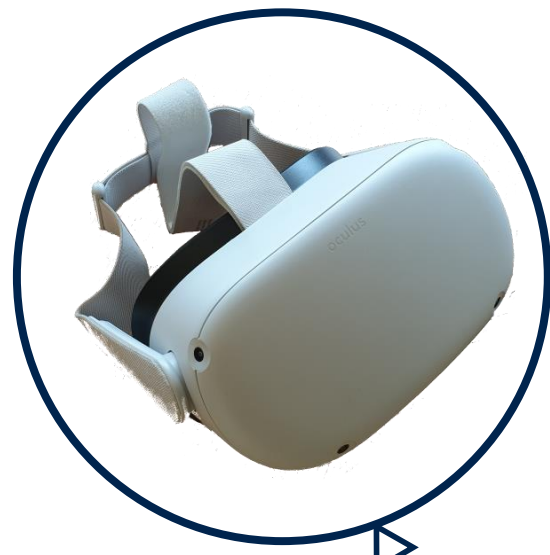
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Source: Alexander Dummer on Pexels

VR – Aviation



Valentino et al. (2017)
Oberhauser et al. (2018)
Olaganathan et al. (2021)
Aguilar Reyes et al. (2023)

(own software)
(VRFS and FSTD fidelity)
(maintain flight skills)
(adaptive flight training)

Cross et al. (2022)

the technology has been successfully introduced in many industries, although appropriate academic research to prove its effectiveness is required.



Objective

- Compare the **engagement** during an emergency landing between a VRFS and a FSTD

FSTD



VRFS

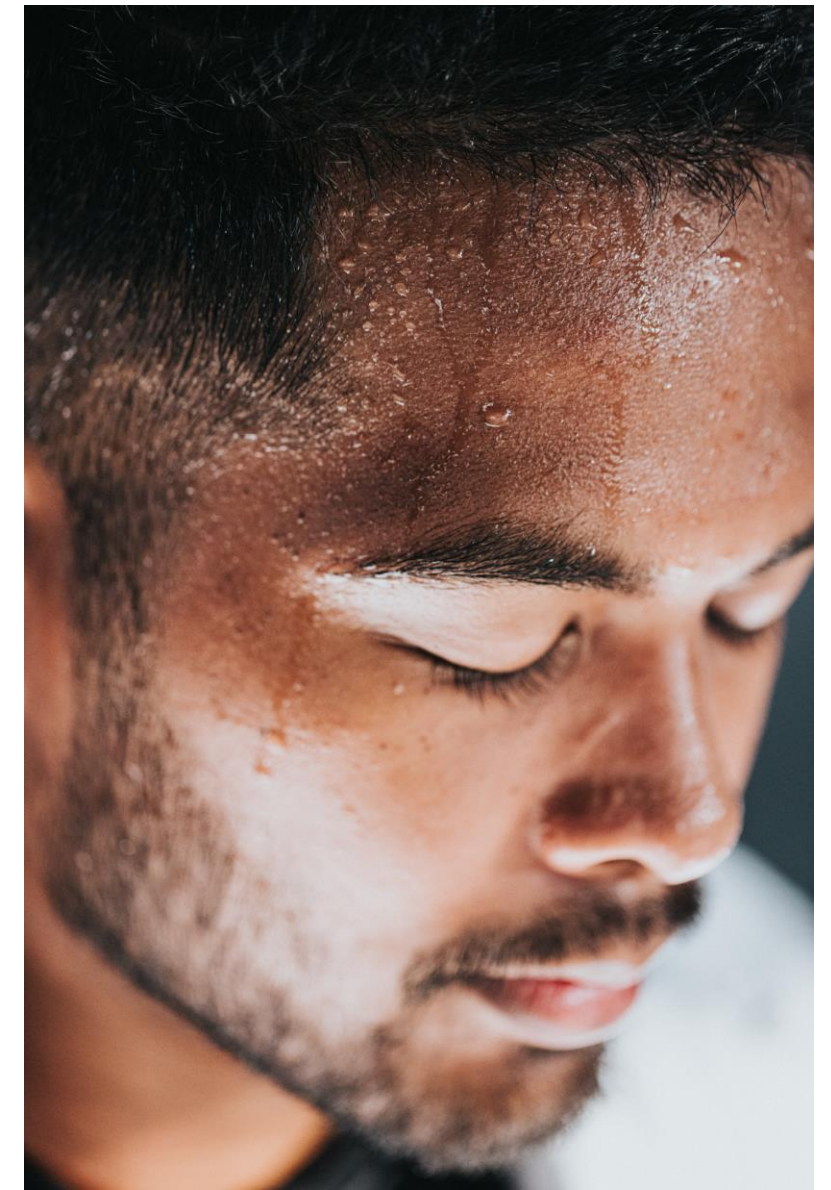


Engagement as the fact of being involved with learning

- ElectroDermal Activity (**EDA**) measures the short-term stress when activating our sympathetic nervous system
- The higher the EDA, the higher the engagement
- We can measure EDA with a **wristband**

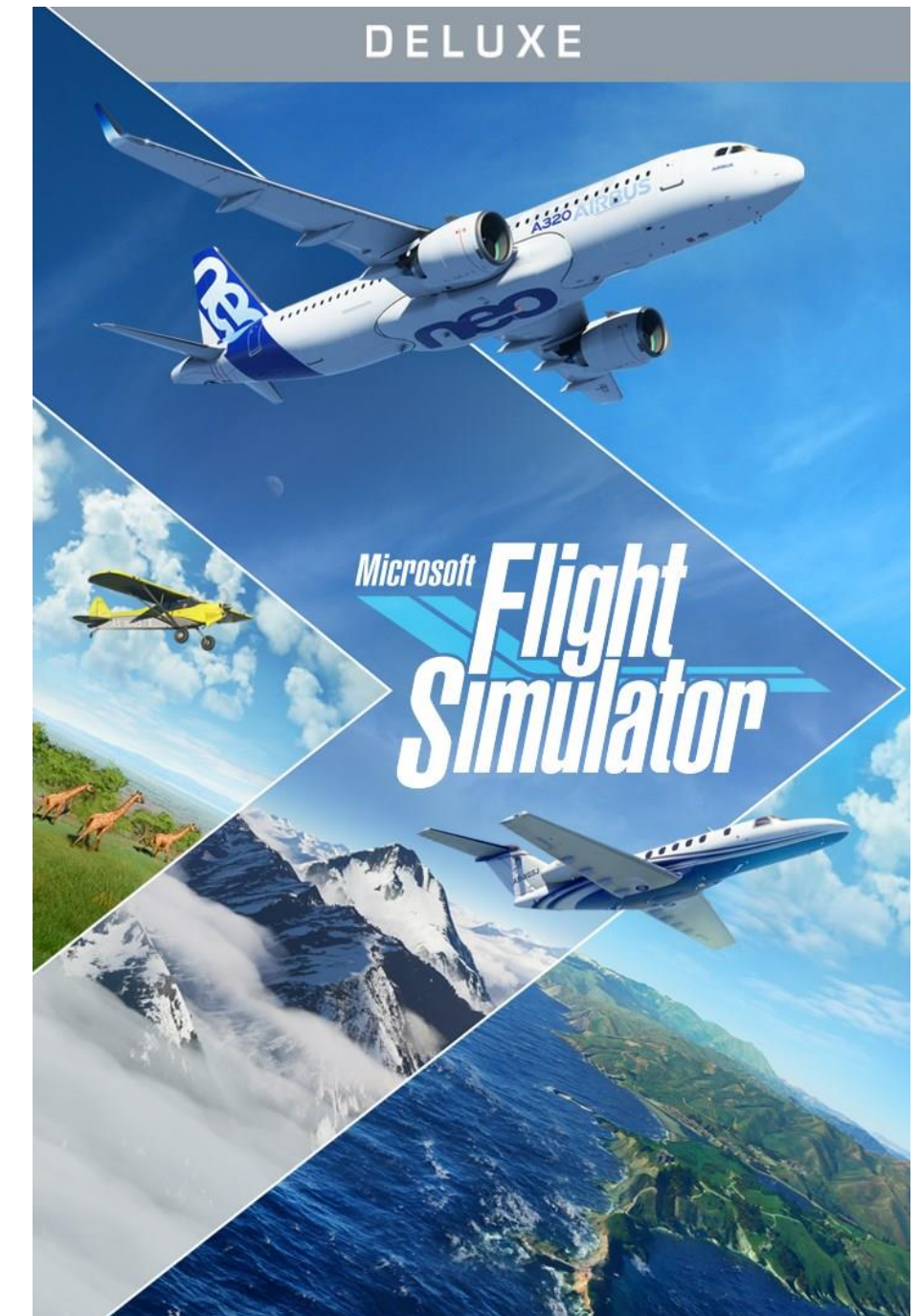


Empatica E4 wristband



Source: Nathan Dumlao on Unsplash

Experiment setup (VRFS)



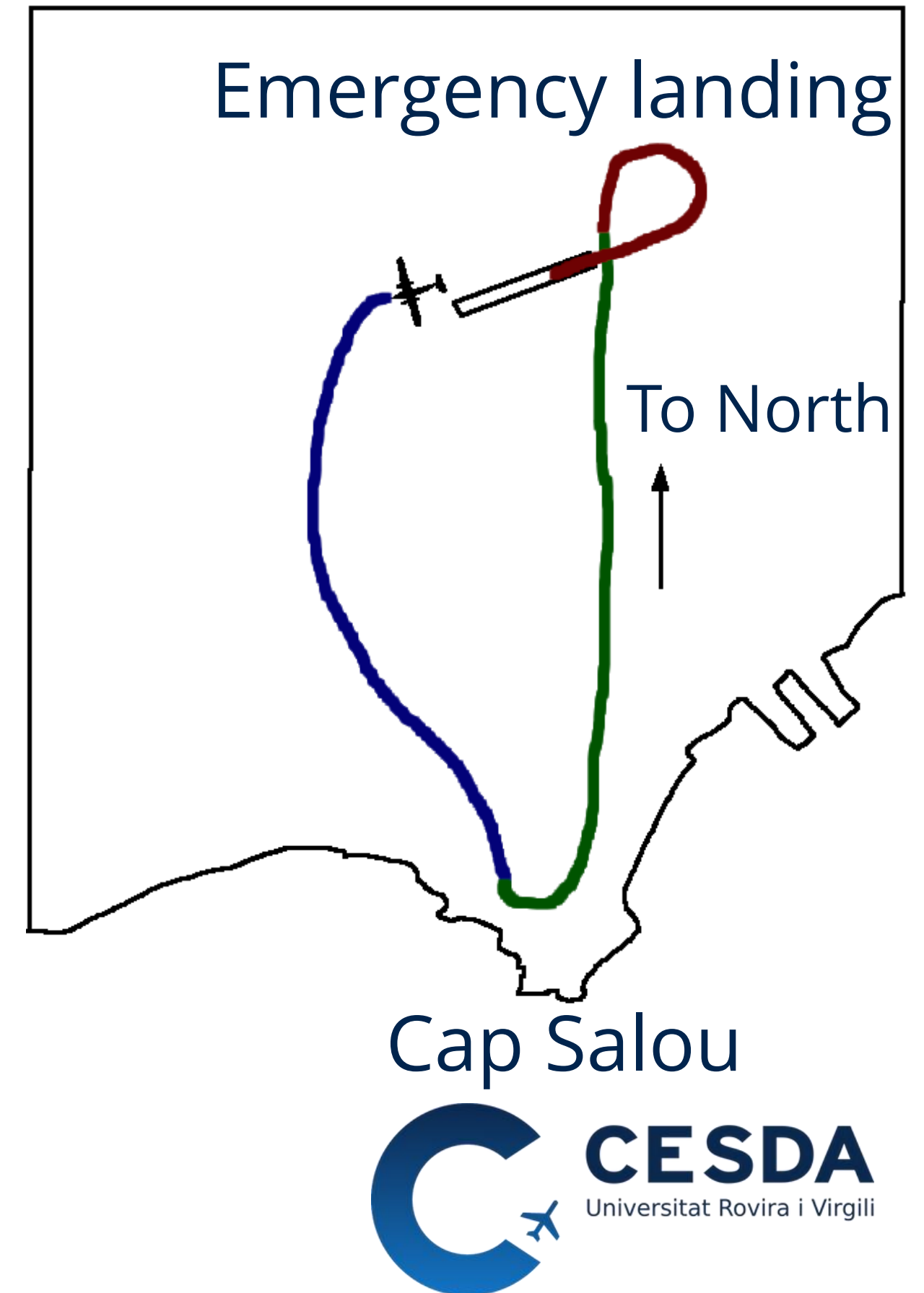
Source: Microsoft Flight Simulator

Experimental setup

- DV20 aircraft
- LERS airport
- 29 student pilots

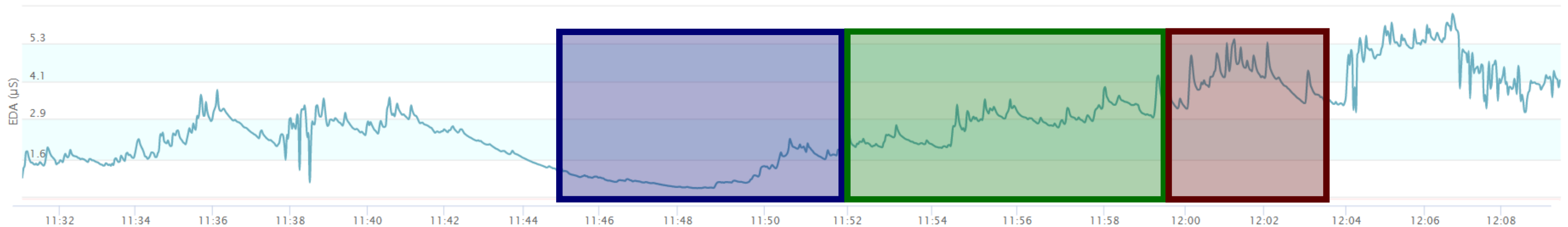
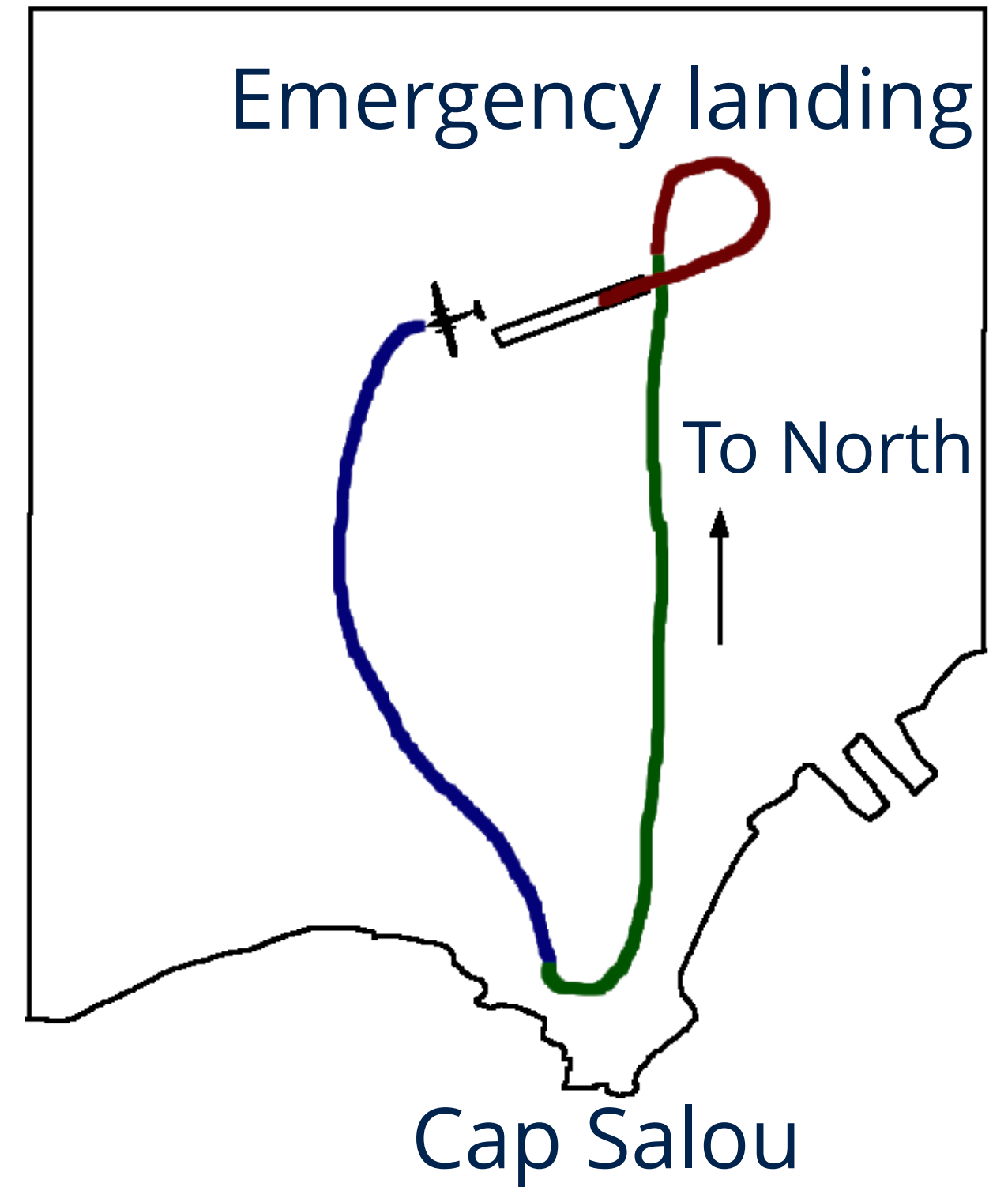


Source: Microsoft Flight Simulator



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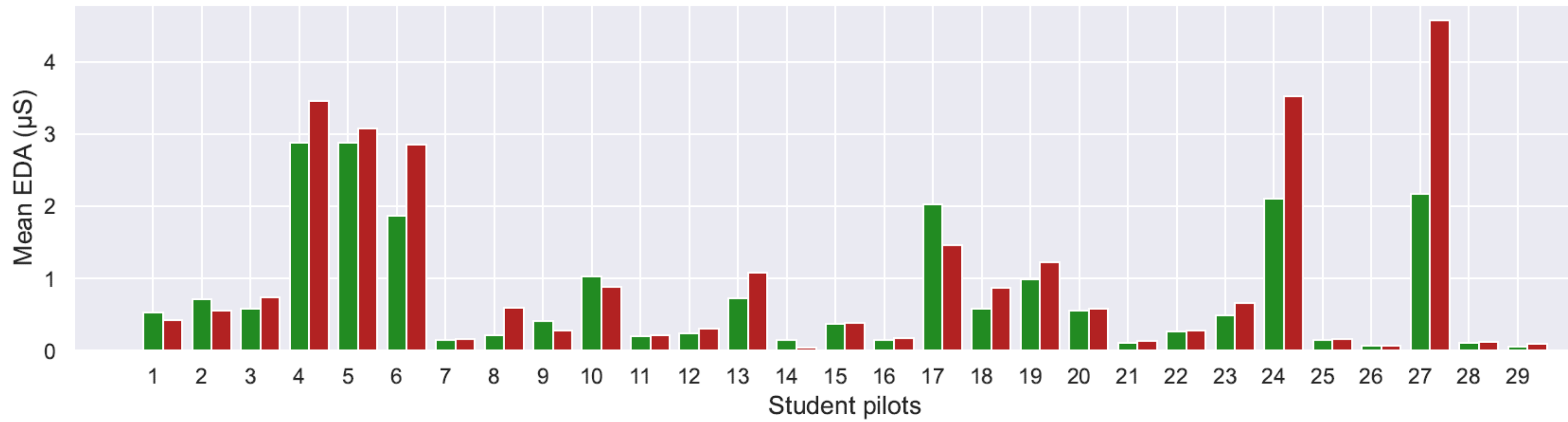
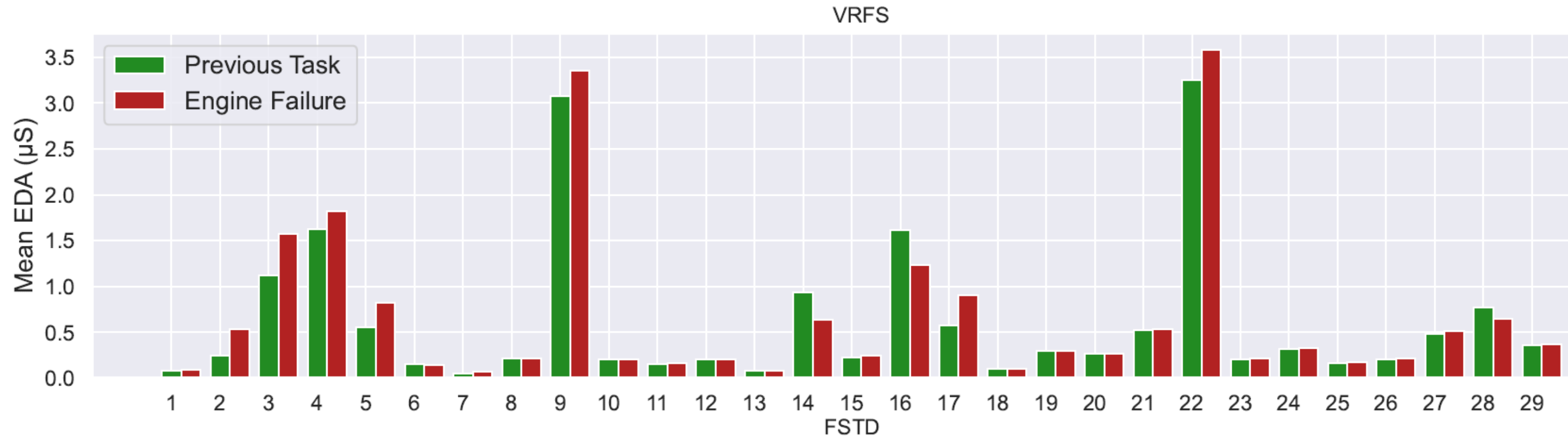
- EDA measurement (real-time)
- IBI measurement (real-time)
- NASA-TLX measurement (after session)



> 75 flight hours

Results (engagement, EDA):

- **VRFS:** 75.9% 84%
- **FSTD:** 79.3% 88.9%



Results (technical):

VRFS: Oculus Quest 2

- **FOV:** 89°
- **Refresh rate:** 120Hz
- **More affordable**
- **Smaller in size**
- No tactile instruments



FSTD: DA42-TDI Twin Star

- FOV: 200°
- Refresh rate: 60Hz
- More expensive
- Larger in size
- **Same instruments as aircraft**



Conclusions of our experiment

- **Engagement** was similar in VRFS and FSTD (and lower in novice students)
- VR is a promising tool to **support** flight training
- Further research is needed to certify its **effectiveness**
 - Tactiles cues?
 - Workload
 - Performance improve?
 - Cybersickness safety?
 - Technological issues with instructors?

Thanks for your
attention



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