



# Towards virtual labs

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# Towards virtual labs

## WHY

CAPACITY



TIME



COST



BUT...

*Educational improvement ?*

# Basics



Conventional

Remote

Virtual



# Basics

Conventional

Remote

Virtual



- Hands-on experiences
- Physical presence in the laboratory
- Traditional Labs

Photo: Waterlab - CITG TU Delft

# Basics

Conventional

Remote

Virtual



- Controlling geographically detached equipment
- Mediated by distance
- Require space and devices

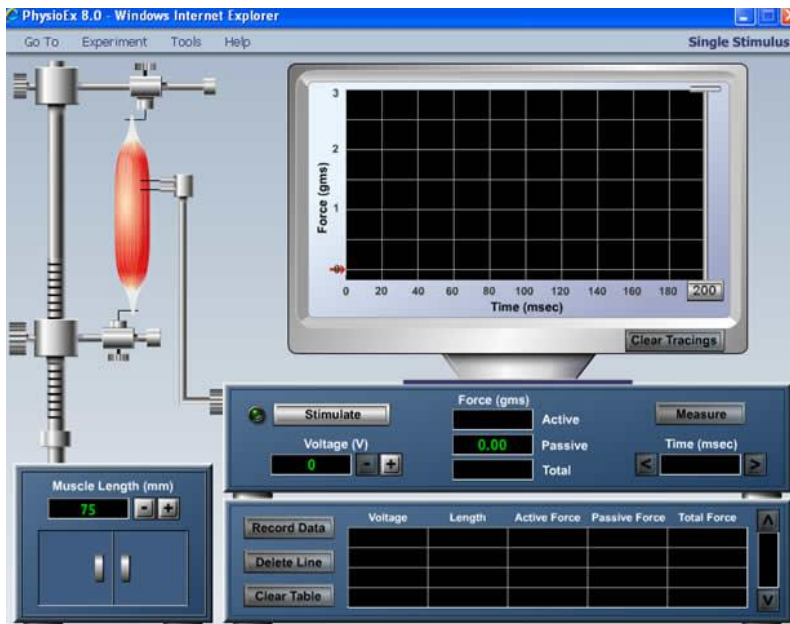
Photo: UPC Barcelona

# Basics

Conventional

Remote

Virtual



- Virtual 2D
- Imitation of real experiments
- Infrastructure is stimulated on computers

Photo: University of Toronto

# Basics

Conventional

Remote

Virtual



- Virtual 3D
- Gamification

Photo: Labster

# PRO

Conventional

Remote

Virtual



- Memorisation by processing senses
- Development specific motor skills
- Face to face interaction

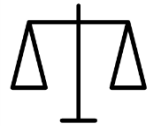
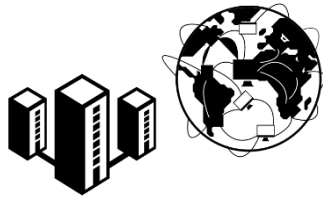


# PRO

## Conventional



## Remote



## Virtual

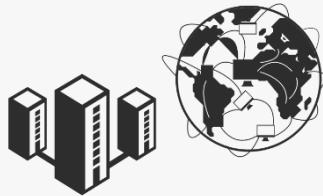
- Use of unique labs around the world
- Safety
- Equal learning opportunities
- Student can manage own time

# PRO

## Conventional



## Remote



## Virtual



- Observing concepts that you can't see with one's bare eyes.
- Easily upgraded
- Preparation or Practice

# CON

Conventional

Remote

Virtual



- Location
- Capacity
- Time
- Cost

# CON

Conventional



Remote



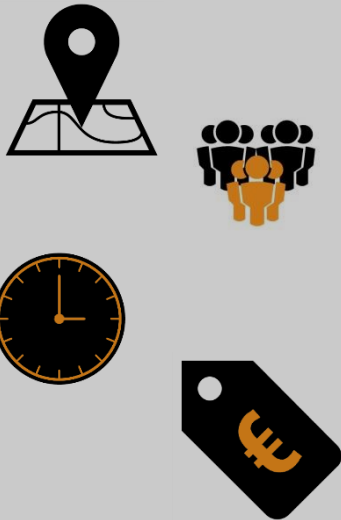
Virtual



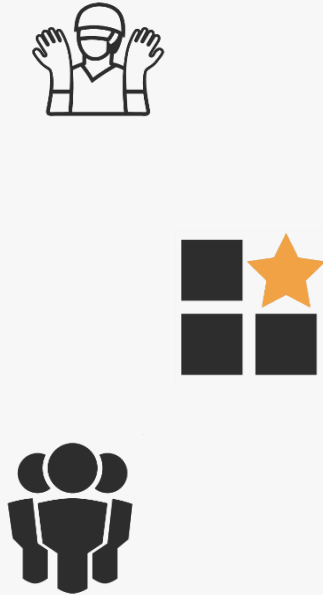
- Safety awareness
- Differentiate from other universities
- One group at a time

# CON

## Conventional



## Remote



## Virtual



- Workload teachers
- Quality control
- Limited by programming

**BUT** is it enough to change the improve education?



- Guidance
- Feedback
- Interaction
- Personalisation

# Next step



- VR glasses
  - Oculus Rift
  - Samsung VR
  - Google Cardboard
- Physical environment

Photo: University of Minnesota

# Next step

Conventional

Remote

Virtual

Virtual reality

## TECHNOLOGY

- Use of holograms
- Microsoft HoloLens





# Question



Following innovation or creating innovation?