

CAP'VR Project

Mimbus Chemistry by Le Cnam

Conservatoire national des arts et métiers (Le Cnam)

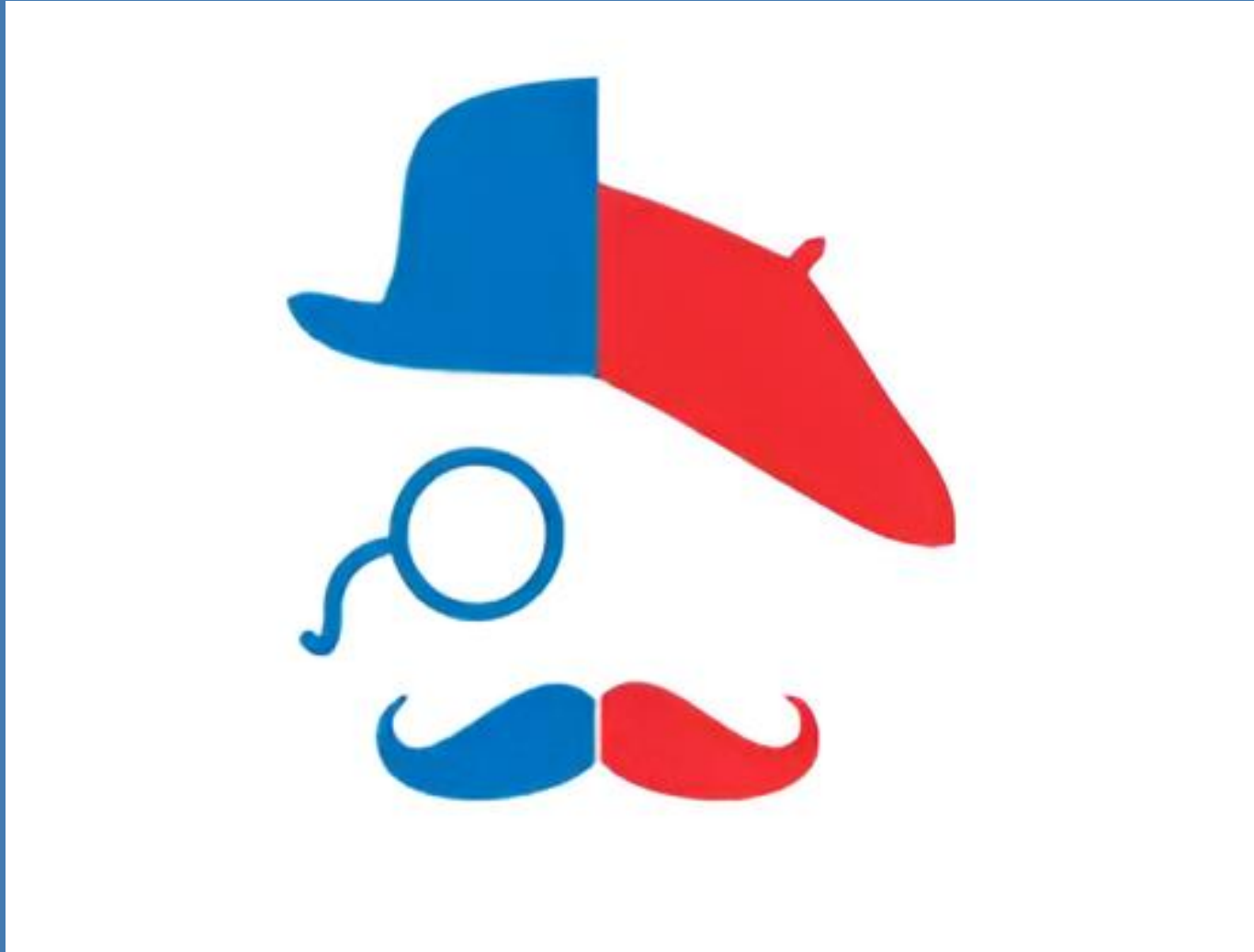
Media & Learning Conference – Leuven 2026

Christian COUSQUER, Maité SYLLA – CAP'VR & All



Preamble

Media & Learning



This presentation will be in '*Frenglish*'.





Questions?

Media & Learning

Question 1

What “CAP’VR” stands for?

What is Mimbus Chemistry?



Simple, Ma'am!





- The team project is called CAP'VR. It stands for “Chemistry, Agri-food, Pharma Virtual Reality”,
- Mimbus Chemistry is the name of the software.

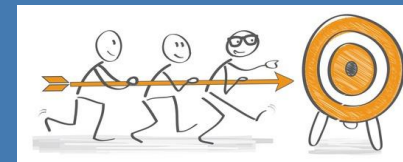


Mimbus Chemistry is a Virtual Reality Digital Twin for Learning of chemistry labs

Since 2020:

Why?

- Heterogeneous student population,
- Limited time allocated to practical work Sessions,
- Interest in educational digital innovation,
- An institution strategic priorities.



It enables learners to acquire professional gestures, technical procedures, and safety reflexes in a secure, repeatable, and cost-effective environment.

For learners ranging from first-year undergraduate level to engineering level in chemistry, agri-food & pharma-related fields.



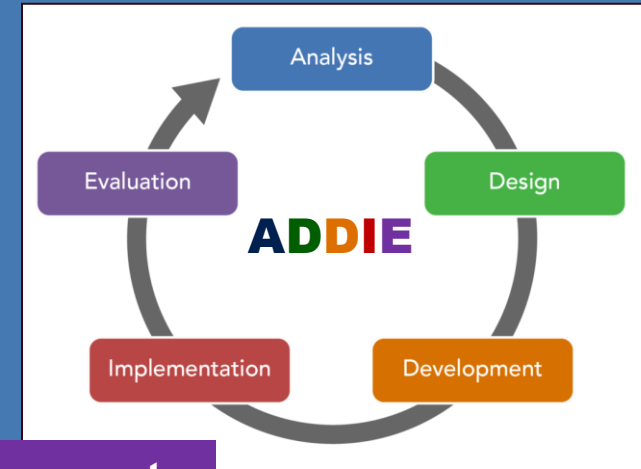
By whom? For whom?

- 21 members, including 14 teachers/researchers, from 8 disciplines
- 7 Engineers, technicians
- 5 Departments, including 1 in HSS
- 10 Degree programmes, 19 teaching units (practical work)
- 3 socio-economic partners

Not a replacement for real-world training sessions in the lab!

Since 2021: More than 800 learners

Our approach: from virtual to real



Design, development



Deployment implementation

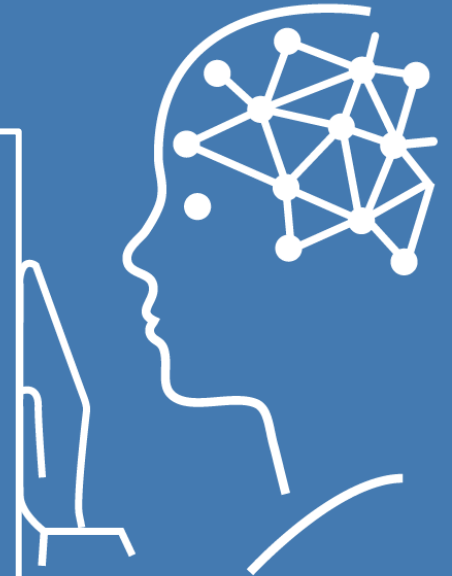


Evaluation, assessments



Question 2

So, Virtual Reality is not reality?



Yes Ma'am!



It's a 'quasi-reality'

- We should have called it 'artificial reality' or 'vicarious reality' ... (© Jean Leborgne- la Présence)

Virtual Reality (VR): a powerful teaching medium

VR can offer a far more visceral experience than traditional screen-based media. It appeals to the user's spatial memory, gives them a sense of scale and, in many cases, serves as an emotional and memory amplifier of the experience.

An immersive practical work session uses a virtual reality headset.

Active teaching: Spect-actor

The virtual reality headset creates the sensation of being transported to another world.



Question 3

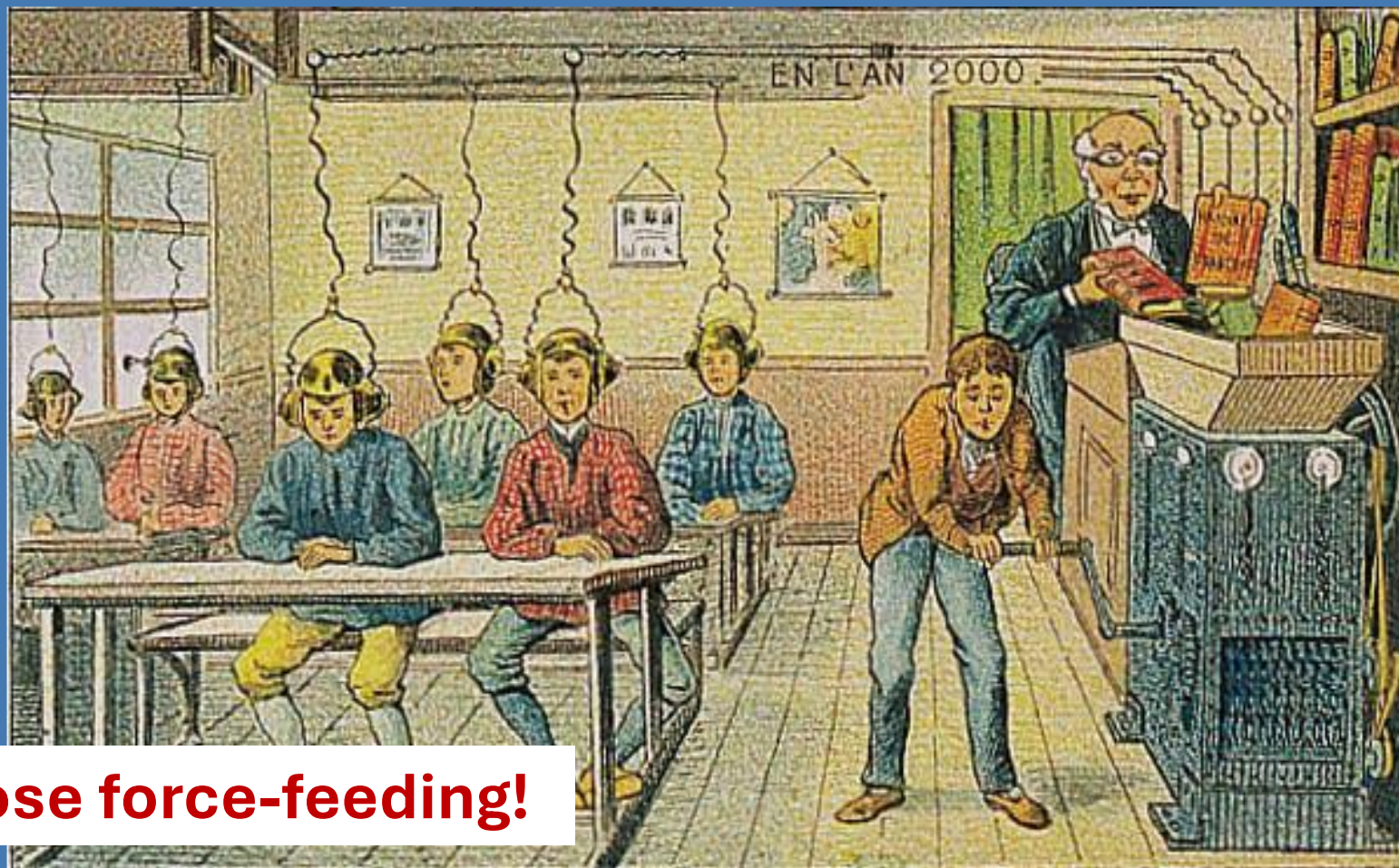
Is a VR digital twin for
learning sufficient in itself ?



No Sir!



That's not this!



— It's not cerebral goose force-feeding!

Teachers' commitment is essential.

It is a highly structured teaching program

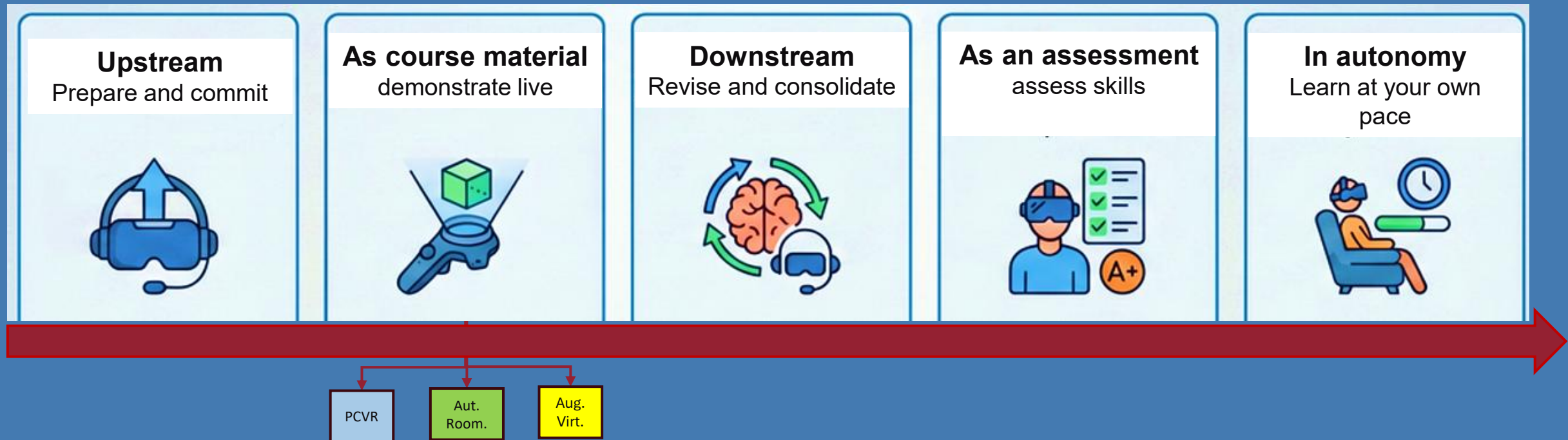
Briefing

Immersive Session

Debriefing, Conclusion



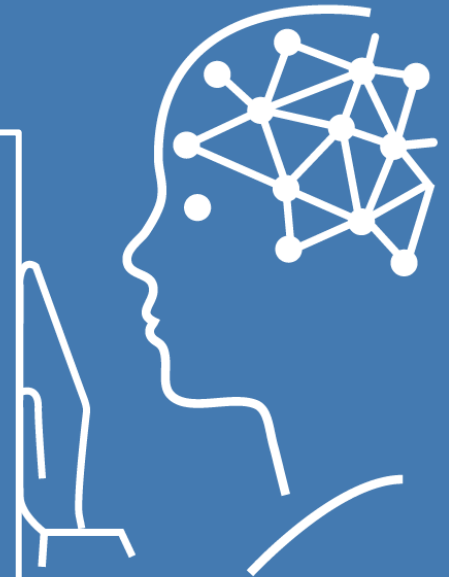
Where should a VR module be placed within an existing curriculum?



Anywhere is possible...

Question 4

Is a digital twin just a video game, but with an immersive bonus?



SHOWTIME

No Sir!



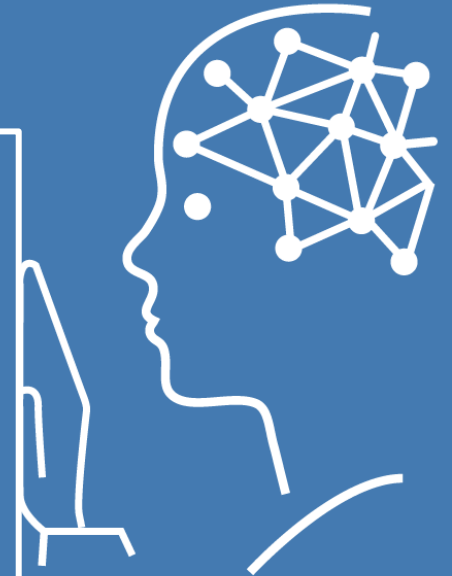


This isn't just 'a bit of fun'.

- The system is carefully designed.
- The main difference between this and a video game is that it has **educational goals**.
- Gamification is a natural result, not something we actively seek.

Question 5

So... All these 'metaverse things' are not efficient in teaching?





Oh Hell nah, Ma'am!

We have metrics : it works!

User Experience

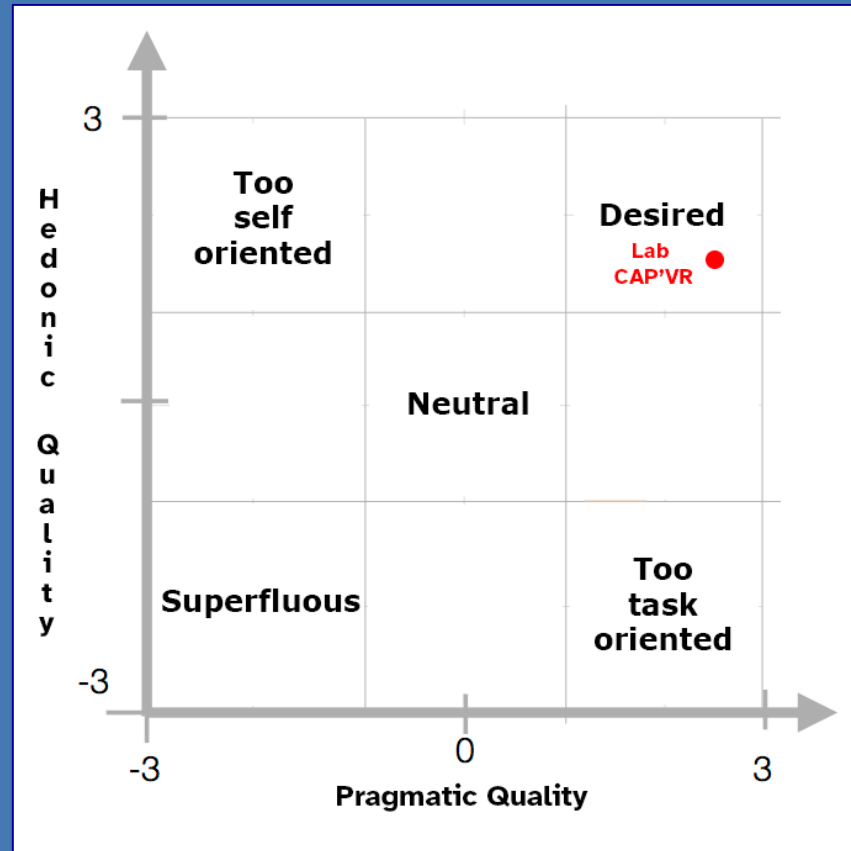
Students and disciplinary and technical experts

Educational benefits

AttrakDiff Questionnaire

User experience

Attractiveness
Usability
Desirability
Ergonomics
Accessibility



CHR107 - Temps ouvrable : TP contrôle en chimie organique (2023 - 2024 Semestre 1) / Sections / Questionnaire TP Virtuel / Prévisualisation

Questionnaire TP Virtuel

Test Paramètres Questions Résultats Banque de questions Plus ▾

Question 1
Pas encore répondu
Noté sur 1,00
Marquer la question
Modifier la question

Que vous a apporté la réalité virtuelle dans le cadre de votre TP réel (par ex : moins d'appréhension, meilleure compréhension du déroulé du tp, sensibilisation accrue aux aspects sécurité) ?

Question 2
Pas encore répondu
Noté sur 1,00
Marquer la question

Avez-vous développé de nouvelles compétences/capacités grâce à la réalité virtuelle ? Si oui lesquelles ?

Question 3
Pas encore répondu
Noté sur 1,00
Marquer la question

Avez-vous rencontré des difficultés à utiliser la réalité virtuelle (sensation de mal-être, difficulté de préhension ou proprioception) ? Si oui lesquelles ?

We have a second metric: for Teachers

User Experience

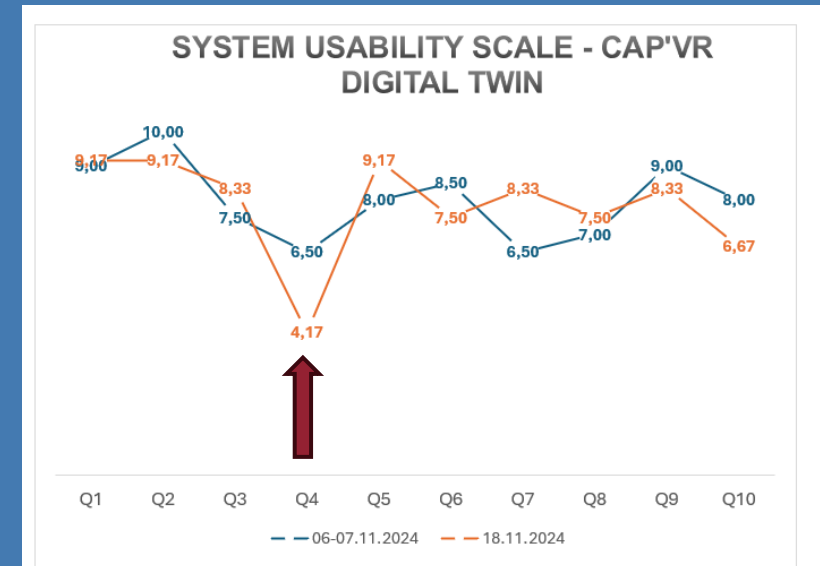
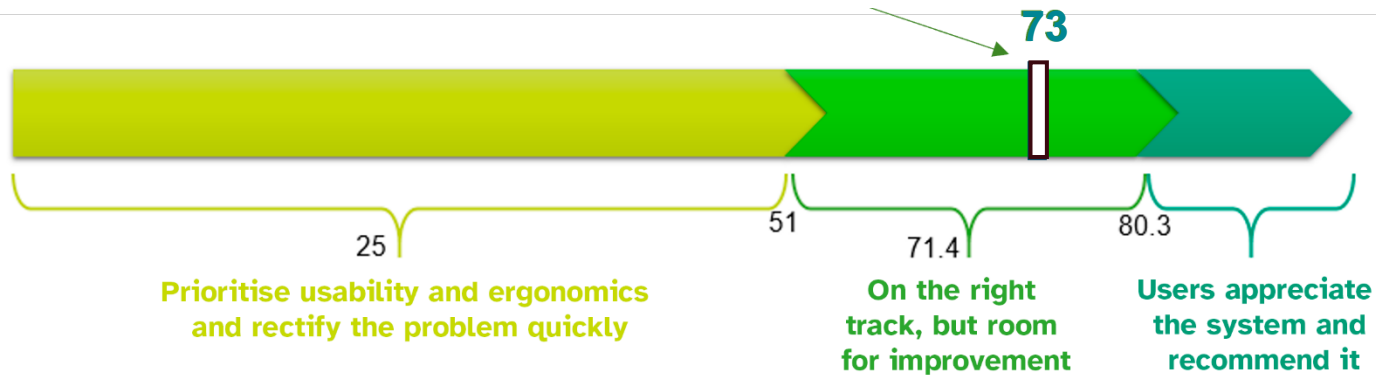
Teachers and technical experts

Educational benefits

System Usability Scale (SUS) Questionnaire

Measuring perceptions of the usability and acceptability of CAP'VR during immersive practical sessions

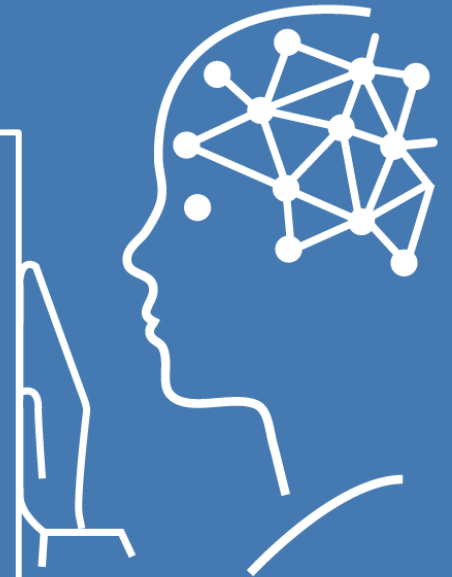
Digital Twin CAP'VR
21 Expert & Teachers Users
January to November 2024-2025



Q4: 'I would need technical support to be able to use this system'

Question 6

Should trainers and teachers try out new ways of teaching to make the most of the possibilities offered by VR?





Yes, Ma'am!

A new stance: towards experiential learning

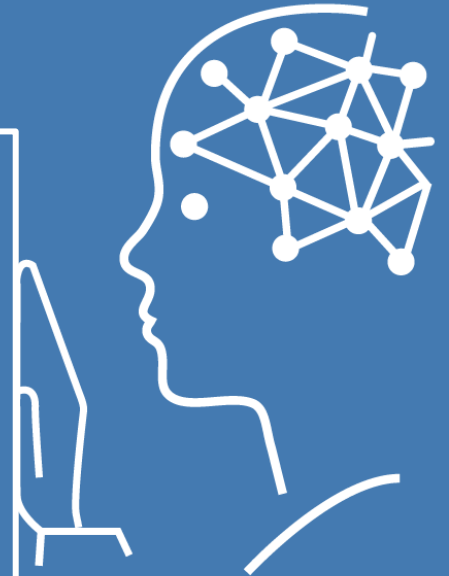
In an immersive learning environment, teachers are no longer merely transmitters of knowledge. They become facilitators of experiences, helping learners to navigate and interact within complex virtual worlds.

This shift requires them to acquire new skills, particularly in facilitation, experience design and coaching.

They must also be able to incorporate elements of gamification, use analytics tools to personalise the monitoring of learners' performance, and understand some of the technical aspects of VR.

Question 7

Is it good to keep your students on their toes before an immersive practical session and tell them nothing before and give them a big lifetime surprise?



No Sir!



Jamais ! Never! Blasphemy!

- Do not cause learners any psychological shock.
- Prepare them in advance with a detailed handout, as you would for a standard practical session.

The image displays four handouts from le cnam and Mimbus, detailing the CAP'VR virtual reality training program. The handouts are organized into a 2x2 grid.

- Top Left Handout:** Titled "Introduction du maniement des outils pour faire de la réalité Virtuelle avec CAP'VR". It describes the program as a document of preparation for conceptual immersive practical exercises. It features a red building illustration and the text "Chimie Agro Pharma Virtual Reality".
- Top Right Handout:** Titled "Travaux pratiques virtuel avec CAP'VR". It lists the objectives of the immersive practical exercises:
 1. **Decouverte de l'environnement de laboratoire :** Familiariser les apprenants avec l'environnement d'un laboratoire de travaux pratiques dans les domaines de la chimie, de l'agroalimentaire et de la pharmacologie.
 2. **Apprentissage des notions de sécurité :** Aider les utilisateurs à mémoriser les bons réflexes face aux situations dangereuses en laboratoire.
 3. **Simulation réaliste des risques :** Offrir la possibilité de vivre, en toute sécurité, des situations dangereuses difficiles à reproduire dans la réalité, grâce à l'immersion en environnement virtuel.
- Bottom Left Handout:** Titled "POURQUOI OUI LA RÉALITÉ VIRTUELLE ?". It explains the benefits of virtual reality, such as creating a safe environment for learning and allowing users to experience dangerous situations without real-world consequences. It includes an illustration of a person wearing a VR headset.
- Bottom Right Handout:** Titled "Les doigts de la main". It provides a diagram of a hand with fingers labeled: Pouce, Index, Majeur, Annulaire, and Auriculaire. It also includes a small image of a person using a VR headset.



This system is no simple matter

- If you have epilepsy, are pregnant, or have a heart condition: virtual reality is off-limits to you.
- If you suffer from big travel sickness, to avoid overly intense episodes of motion sickness. Ditto
- If you have difficulties with visual-vestibular coordination, balance disorders, or inner ear disorders. Ditto
- If you suffer from oculomotor disorders or have difficulty viewing 3D films at the cinema. Same applies

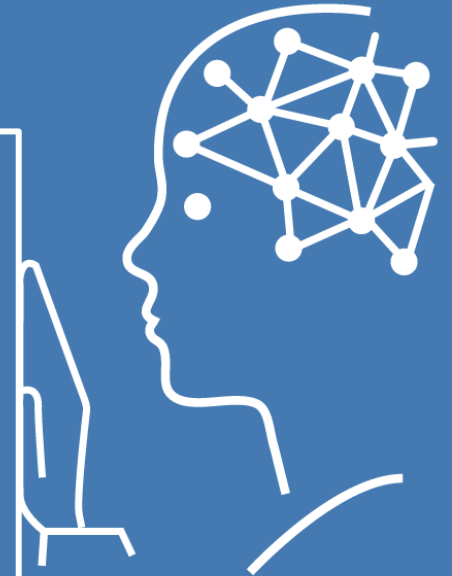
Psychological disorientation: Trapped in VR

“The phenomenon of psychological disorientation or cognitive inhibition can occur during a virtual reality experience and slow down or override positive self-preservation reflexes.”



Question 8

Do learners have any surprising reactions when using VR Digital Twins?





Yes, Ma'am!

Proteus effect

The Proteus effect describes a phenomenon in which an individual's behaviour in virtual worlds is altered by the characteristics of their virtual avatar.

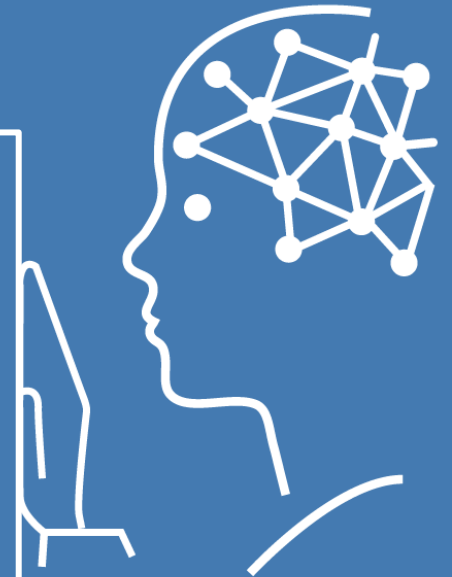
We observed the Proteus effect in the laboratory: women with male virtual hands made strangely more abrupt movements...

We will therefore give users the option to choose between male and female virtual hands.



Question 9

Do you think it's important to make sure the experience is accessible to people with disabilities and other groups?
So, does this personalisation actually work?





Yes, Ma'am!

Accessibility features

Visual and haptic feedback:

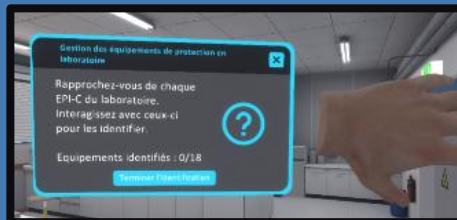
Teleportation -> associated with the colour **purple**

Picking up an object -> associated with the colour **blue**

Activating an object -> associated with the colour **yellow**



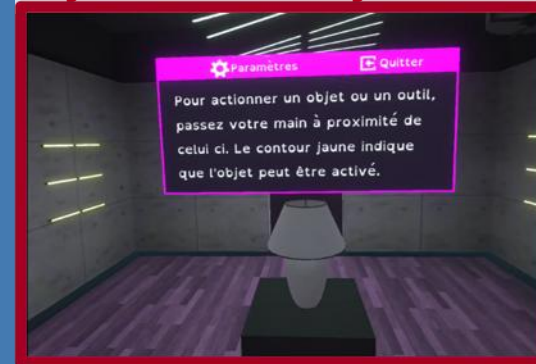
Subtitles and audio instructions



"No one left behind"

All these Accessibility settings have been built by, tested with, and for people with disability ✓

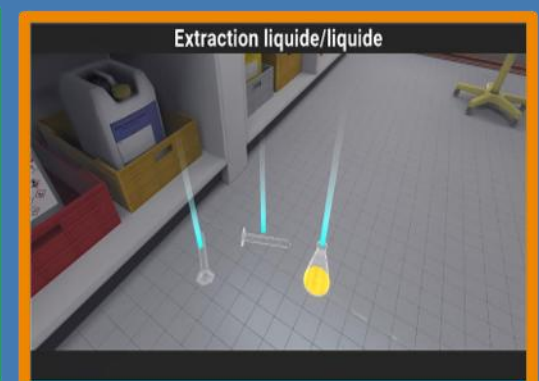
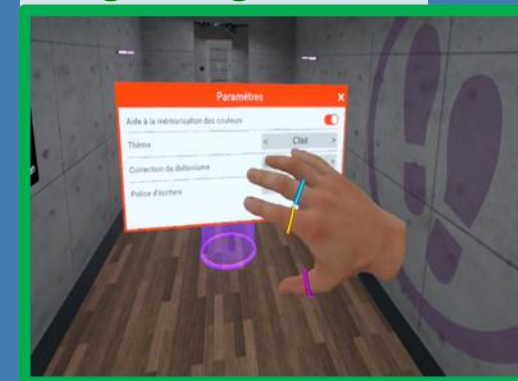
Dyslexia-friendly fonts



Colour blindness filters



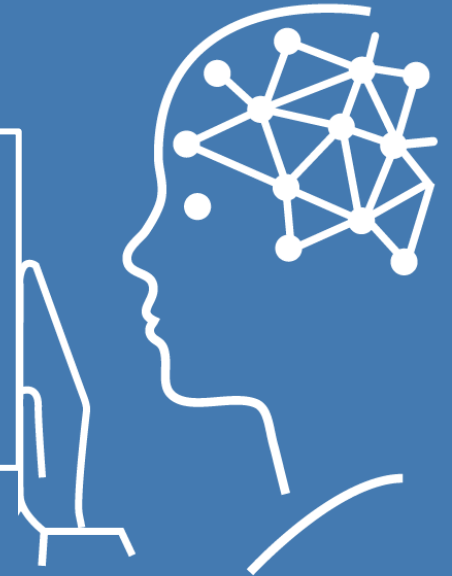
Magic rings



Laser for picking up objects on the floor

Question 10

So, all that VR kit must cost a bomb?!



No Sir!



Very good VR headsets cost
between 600,⁰⁰€ and 650,⁰⁰€
So that argument about excessive costs
doesn't hold water!





Thank you



anr[®]
agence nationale
de la recherche



**Région
île de France** le cnam



- Prix DEF, SCF (2025)
- EUNIS Dørup Awards (2025)



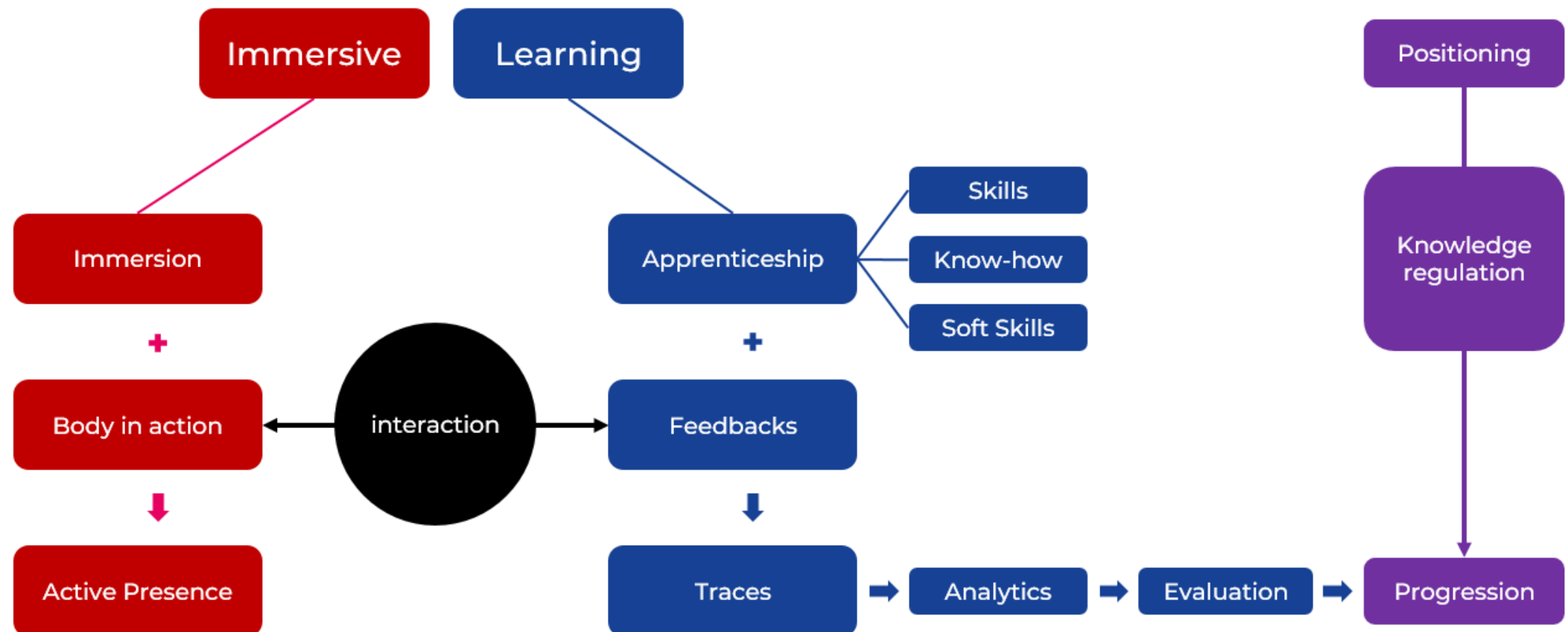
Do you have any questions?

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Bonus slides

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Did you say “immersive learning”?

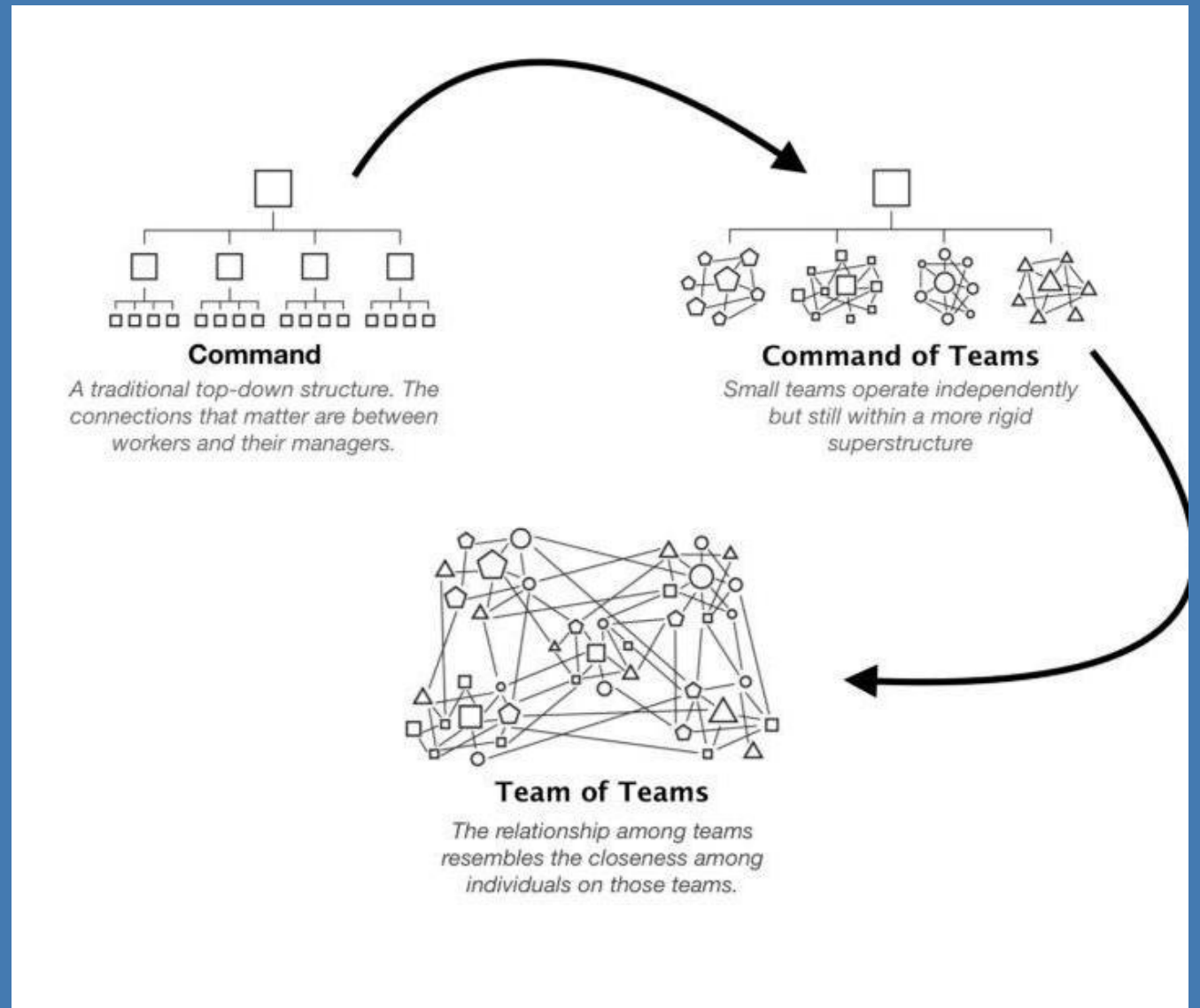


Collective intelligence

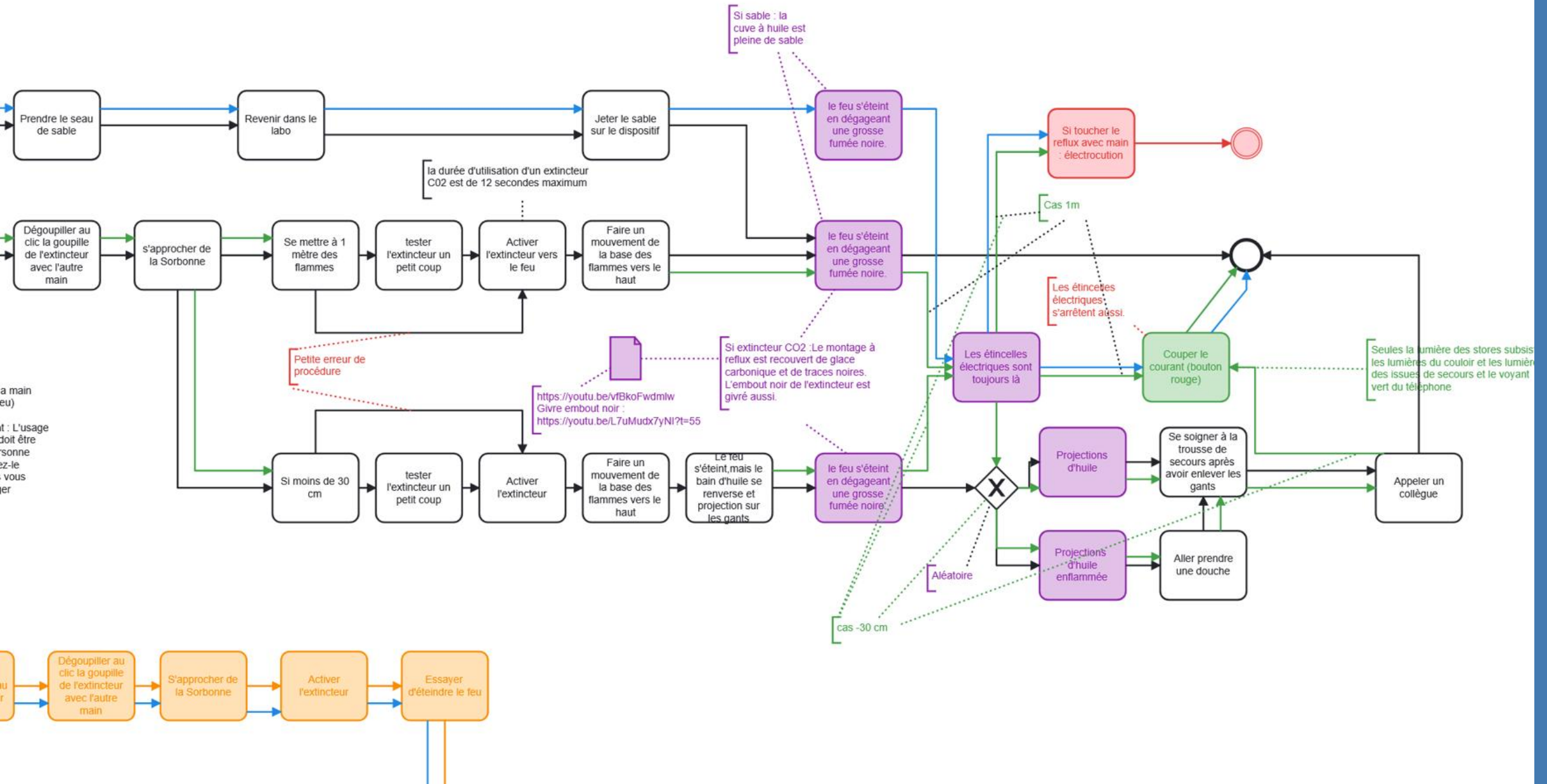


- Perception of the whole / Holoptism,
 - A shared identity (feeling of belonging to a group),
 - A social contract,
 - Rituals,
 - Common goals,
 - Gift economy ("I don't keep things for myself" - idea of sharing),
 - Circulating object-links (something in motion within and between members)
 - Learning organization
- ref.: jean- françois Noubel

Teams of Teams



Finding a common language between technique, content expertise and pedagogy





Physical
Twin
Laboratory



Digital
Twin
Laboratory

The importance
of the hallway...

Modular Design:
if we need a new
lab, we just need
to add a door...



Tutorial

Beginner – Advanced – Expert
Levels

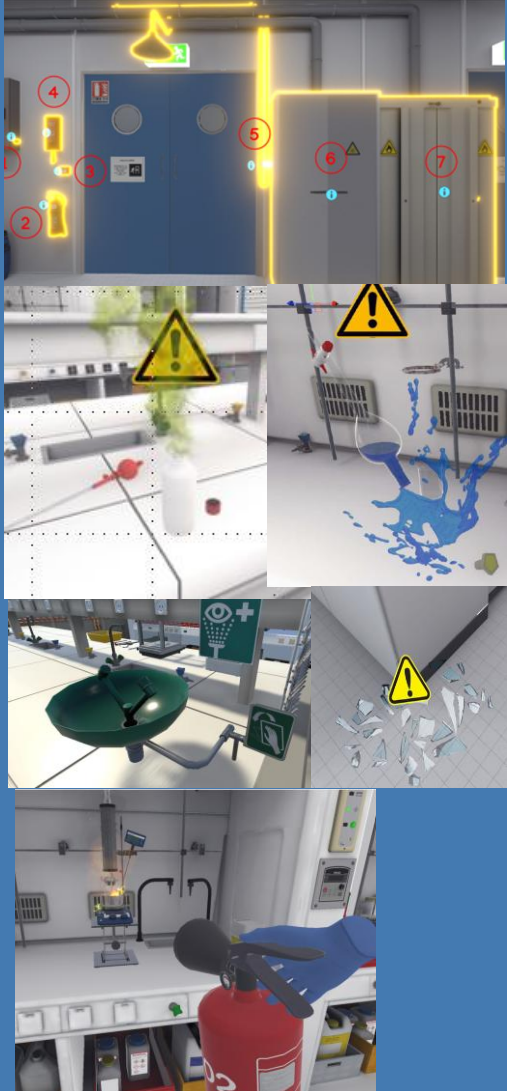
Personnalised Learning Pathway
with Video4XR LMS Plug-in

LTI latest version

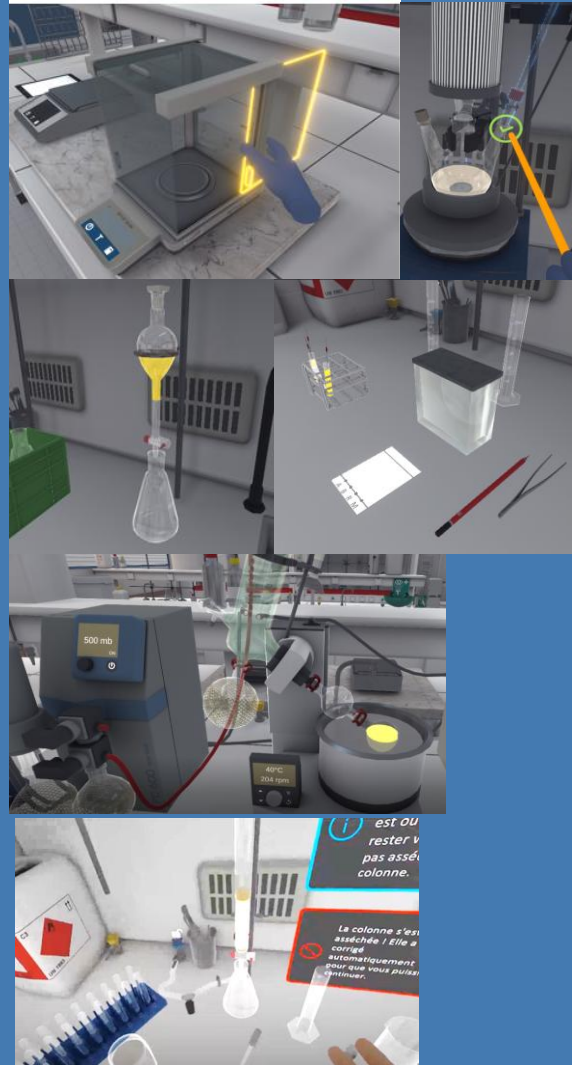


3 Chapters: 15 modules

Safety in lab (5)



Common handling (6)



More complicated equipment (3)



Augmented virtuality Device: No one left behind!

Addressing learners who can't put a VR headset – peer learning – the metaphor of the teacher or a student acting (virtually) in front of a class gathered around the blackboard : context and subjective POV



Testing video 2021: <https://mediaserver.lecnam.net/permalink/v1261c3ddd32f4cebhbdb/iframe/>