Media & Learning – Seminar

# How medical doctors and developers collaborate to develop educational XR applications

## Smart Collaboration Tutor

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# SETTING AND PROBLEM

# SETTING

## TRAINING TO BECOME…


# Core competences of a (future) doctor

# Collaborative Problem Solving

## CPS FRAMEWORK (OECD, 2017)

**Table 7.1 Matrix of collaborative problem-solving skills for PISA 2015**

| | (1) Establishing and maintaining shared understanding | (2) Taking appropriate action to solve the problem | (3) Establishing and maintaining team organisation |
|---|---|---|---|
| (A) Exploring and understanding | (A1) Discovering perspectives and abilities of team members | (A2) Discovering the type of collaborative interaction to solve the problem, along with goals | (A3) Understanding roles to solve the problem |
| (B) Representing and formulating | (B1) Building a shared representation and negotiating the meaning of the problem (common ground) | (B2) Identifying and describing tasks to be completed | (B3) Describing roles and team organisation (communication protocol/rules of engagement) |
| (C) Planning and executing | (C1) Communicating with team members about the actions to be/being performed | (C2) Enacting plans | (C3) Following rules of engagement, (e.g. prompting other team members to perform their tasks) |
| (D) Monitoring and reflecting | (D1) Monitoring and repairing the shared understanding | (D2) Monitoring results of actions and evaluating success in solving the problem | (D3) Monitoring, providing feedback and adapting the team organisation and roles |

**Note:** The 12 skill cells have been labelled with a letter-number combination referring to the rows and columns for ease of cross-referencing later in the document.

# Integration in current curriculum

Some thoughts

- Need for reliable and valid data
- Manual analysis is time consuming
- Feedback
- Requirements
  - Expensive
  - Support by coaches

➔Solution?

# INTERVENTION WITH VR

# Simulation training in VR

## Digital "experience twins"

Experience Twin

# RESEARCH QUESTIONS & EXPERIMENT

- Measurement: To what extent can a student's collaborative problem solving (CPS) behaviour in the use case be **mapped and measured**, in a VR multi-user environment?

- Effectiveness: To what extent can student CPS behaviour be **coached in real-time** through scaffolding in the form of nudging?

# VR simulation training

## Subjects

- Simulation training in KULeuven campus Kortrijk
- Faculty of Medicine (3th year)
  - Eva De Wasch
  - Tessa Vandenbogaerde – Impens
  - Caroline Vanherpe
- Pilot: 17 dyads
  Experiment: 21 dyads

# SMART COLLABORATION TUTOR

## CPS TRAINING

- BEFORE
  - Scenario
  - Hardware/software
- DURING
  - Students – coaches
  - Data collection
  - Nudging
- AFTER
  - Debriefing

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# BEFORE

## USE CASE SCENARIO

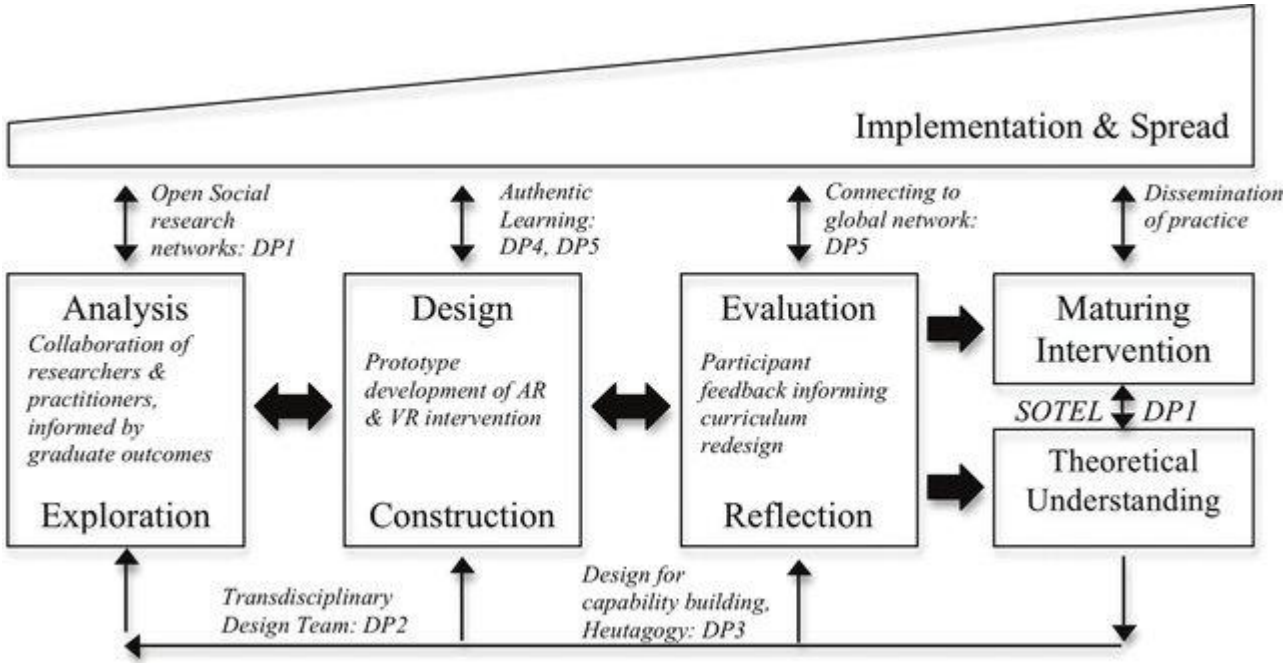


Figure 1. McKenny and Reeves's design-based research stages.
In Cochrane, Thomas & Stretton, Todd & Aiello, Stephen & Britnell, Sally & Cook, Stuart & Narayan, Vickel. (2018). Authentic interprofessional health education scenarios using mobile VR. Research in Learning Technology. 26. 10.25304/rlt.v26.2130.

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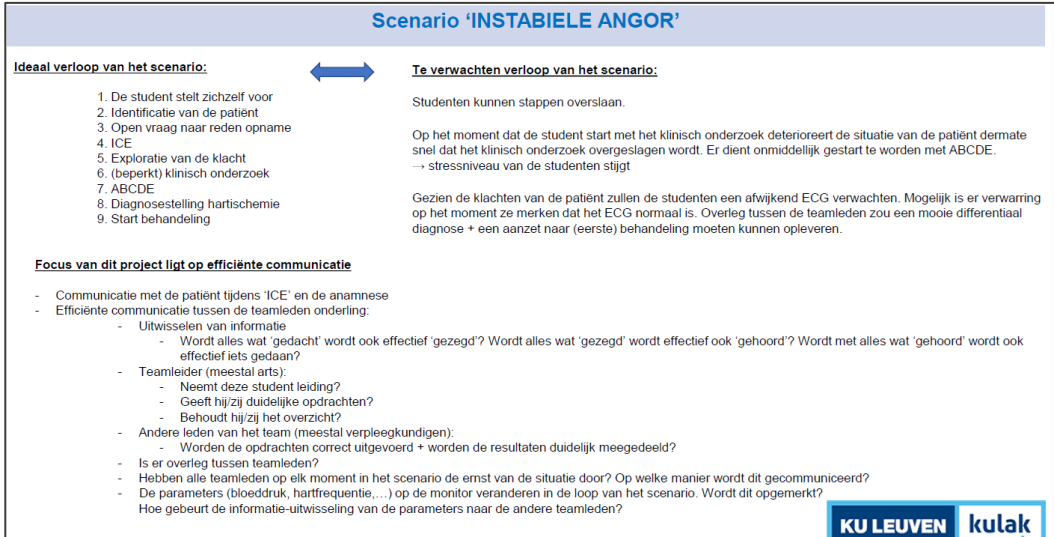
# BEFORE

## USE CASE SCENARIO

- Instabile angor
- Multi-player – Roles
  - Doctor – nurse
- Typical problems
  - Skipping steps & stress
  - Not communicating
  - Lack of relevant actions
  - Not noticing critical parameters
  - Inadequate coordination



**Scenario 'INSTABIELE ANGOR'**

**Ideaal verloop van het scenario:**

1. De student stelt zichzelf voor
2. Identificatie van de patiënt
3. Open vraag naar reden opname
4. ICE
5. Exploratie van de klacht
6. (beperkt) klinisch onderzoek
7. ABCDE
8. Diagnosestelling hartischemie
9. Start behandeling

**Te verwachten verloop van het scenario:**

Studenten kunnen stappen overslaan.

Op het moment dat de student start met het klinisch onderzoek deterioreert de situatie van de patiënt dermate snel dat het klinisch onderzoek overgeslagen wordt. Er dient onmiddellijk gestart te worden met ABCDE.
→ stressniveau van de studenten stijgt

Gezien de klachten van de patiënt zullen de studenten een afwijkend ECG verwachten. Mogelijk is er verwarring op het moment ze merken dat het ECG normaal is. Overleg tussen de teamleden zou een mooie differentiaal diagnose + een aanzet naar (eerste) behandeling moeten kunnen opleveren.

**Focus van dit project ligt op efficiënte communicatie**

- Communicatie met de patiënt tijdens 'ICE' en de anamnese
- Efficiënte communicatie tussen de teamleden onderling:
  - Uitwisselen van informatie
    - Wordt alles wat 'gedacht' wordt ook effectief 'gezegd'? Wordt alles wat 'gezegd' wordt effectief ook 'gehoord'? Wordt met alles wat 'gehoord' wordt ook effectief iets gedaan?
  - Teamleider (meestal arts):
    - Neemt deze student leiding?
    - Geeft hij/zij duidelijke opdrachten?
    - Behoudt hij/zij het overzicht?
  - Andere leden van het team (meestal verpleegkundigen):
    - Worden de opdrachten correct uitgevoerd + worden de resultaten duidelijk meegedeeld?
  - Is er overleg tussen teamleden?
  - Hebben alle teamleden op elk moment in het scenario de ernst van de situatie door? Op welke manier wordt dit gecommuniceerd?
  - De parameters (bloeddruk, hartfrequentie,…) op de monitor veranderen in de loop van het scenario. Wordt dit opgemerkt? Hoe gebeurt de informatie-uitwisseling van de parameters naar de andere teamleden?

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KU LEUVEN kulak

# BEFORE

## VR ENVIRONMENT - Digital twin



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# DURING

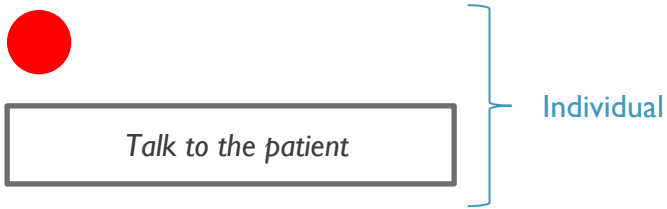
## EXPERIMENT

# Triggering learning processes

**1. Manipulations:** patient parameters

**2. Nudges**: procedural information just-in-time

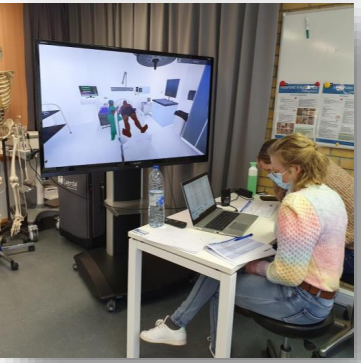
Two types:




**3. Debriefing**: from a manual to a complete computational debriefing (focus 2023)

# DURING

## COACH VIEW, DASHBOARD AND NUDGING



### Introduction

**Communication checklist**

- Introduction
- Identification
- Hospitalisation reason
- Exploration complaint
- Clinical exam

**Expected behaviors**

### Airway

**Communication checklist**

- Address patient
- Trachea checkup
- Capillary refill checkup
- Check up neck veins
- Glasgow coma scale
- AMPLE

### Breathing

**Communication checklist**

- Address patient
- Trachea checkup
- Capillary refill checkup
- Check up neck veins
- Glasgow coma scale
- AMPLE

**Expected behaviors**

- Measure frequency
- Respiratiry movements
- Check for ribfractures (optional)
- Auscultation lungs
- Attach saturation meter

### Circulation

**Communication checklist**

- Address patient
- Trachea checkup
- Capillary refill checkup
- Check up neck veins
- Glasgow coma scale
- AMPLE

**Expected behaviors**

- Attach ECG
- ECG change
- Attach blood pressure monitor
- Check pulse at wrist
- Auscultation heart
- Serve medicine
- Intravenous Drip
- Calling radiology for an urgent RX picture of the lungs

### Disability

**Communication checklist**

- Address patient
- Trachea checkup
- Capillary refill checkup
- Check up neck veins
- Glasgow coma scale
- AMPLE

**Expected behaviors**

- Pupil checkup
- Glycemia checkup
- Temperature checkup
- Move patient's limbs

### Exposure

**Communication checklist**

- Address patient
- Trachea checkup
- Capillary refill checkup
- Check up neck veins
- Glasgow coma scale
- AMPLE

### Conclusion

**Communication checklist**

- Address patient
- Trachea checkup
- Capillary refill checkup
- Check up neck veins
- Glasgow coma scale
- AMPLE

**Nudge controls**

Nudge alert player 1 | Nudge alert player 2

Nudge player 1 | Nudge player 2 | *Nudge text player 1* send | *Nudge text player 2* send

**Global patient controls**

talk trough intercom | heart failure | heart rate = 93 | blood pressure = 93 | saturation = 93

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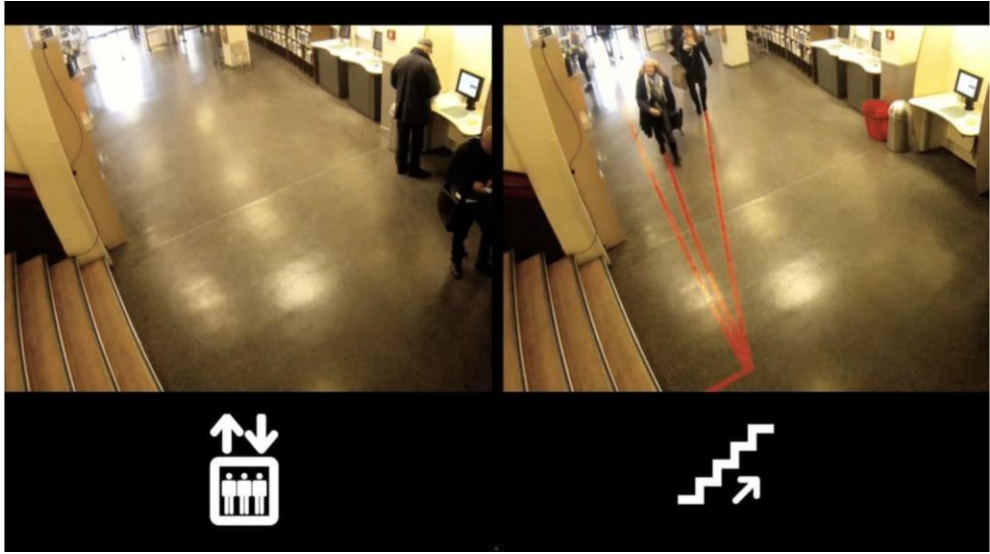
# NUDGING

A nudge is “any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives.”

Thaler & Sustein (2019)



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# The VR-headset is the portal to the training

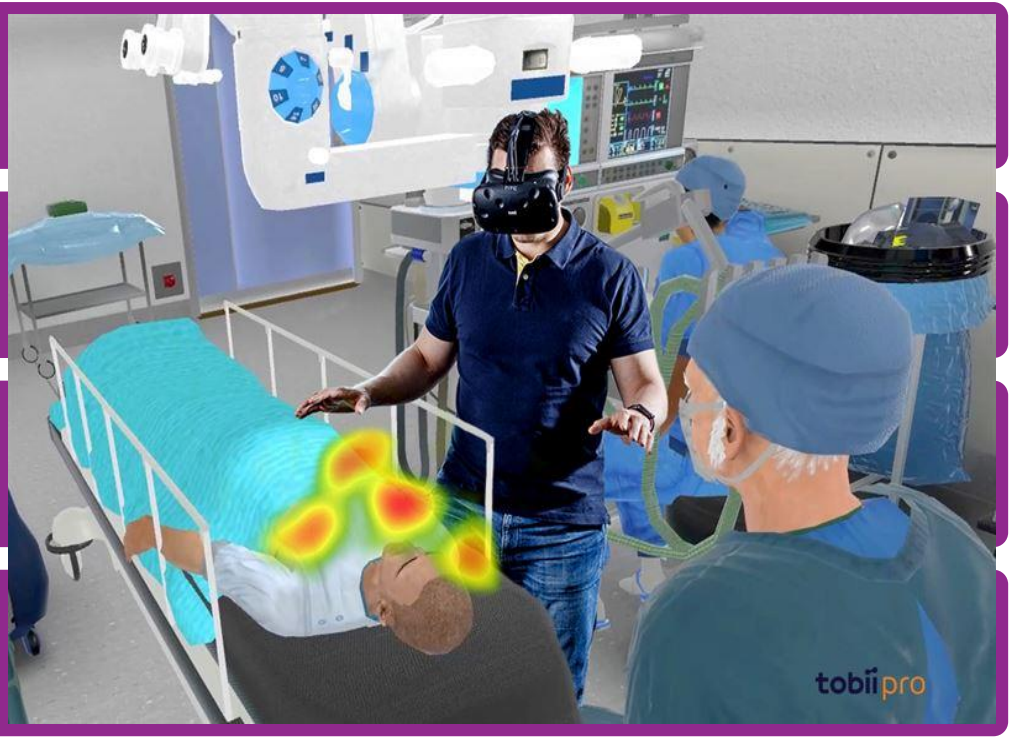
# Multimodal measuring

## Audio
- "CPS-related language"
- Stress measuring

## Eye-tracking
- Area of intrest
- HCCI

## Logdata
- Nudges
- Moments of intrest

## Survey
- User experience
- Personality
- Preferences for debriefing

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# AFTER

## DEBRIEFING

- Survey
  - Experience
  - Social space
- Dashboard
  - Mirroring behaviour
  - Critical moments
- Nudges


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# RESEARCH QUESTIONS & EXPERIMENT

1. How did students experience VR to train communication skills during medical diagnosis
   - ❿ *How do they evaluate the social presence during the VR simulation?*
   - ❿ *To what extent are students' experiences related to their personality?*
2. What is the effect of a nudge on the immediate behaviour of students?
3. Which nudge has more effect on which types of behaviour?
4. At which moments do supervisors give nudges? When do they effectively give nudges to amend behaviour?

NUDGE TYPE


| Variable | N | Min | Max | Mean | SD |
|---|---|---|---|---|---|
| The nudges were supportive for me. | 28 | 1 | 7 | 4.21 | 1.45 |
| The nudges were disturbing | 28 | 1 | 6 | 3.11 | 1.17 |
| The nudges caused stress | 28 | 1 | 6 | 3.29 | 1.44 |

Text > Dot

## NUDGING

- "I didn't see a nudge" (5 students)
- "Feeling of incompetence" (group 1, ID 2)
- "Deliverance" (group 10, ID 101)
- "The nudge allowed us to continue with the scenario, which was positive, but also frustrating because you couldn't come up with it yourself." (group 14, ID 141)

# USER EXPERIENCE

| **Variable** | **Number of items** | Cronbach's Alpha | **N** | **Min** | **Max** | **Mean** | **SD** |
|---|---|---|---|---|---|---|---|
| Social Presence | 4 | 0.705 | 31 | 2.50 | 7 | 4.90 | 1.05 |
| Perceived Usefulness | 4 | 0.756 | 31 | 2.50 | 7 | 4.88 | 0.98 |
| Perceived ease of use | 3 | 0.051 | | | | | |
| VR is flexible in use | 1 | | 31 | 1 | 7 | 4.94 | 1.43 |
| The learning scenario was clear and easy to understand | 1 | | 31 | 3 | 7 | 5.65 | 1.05 |
| The learning scenario demands a high mental effort | 1 | | 31 | 1 | 7 | 4.16 | 1.72 |
| Behavioral intention | 2 | 0.957 | 31 | 2.50 | 7 | 5.43 | 1.29 |

# USER EXPERIENCE

**Testimonials from STUDENTS:**

- *"I found the experience very positive, I am looking forward to using it. I had **less stress** in virtual reality than during the regular simulations, I have no clue how it came. I hope we can practice more!"*
- *"I think this can **become a very valuable tool** for the medical training .You also need less material, I would do this more often if possible."*
- *"The scenario **felt real** after a small amount of time."*
- *"I enjoy the virtual reality scene, you feel like **it's more real**. **Even more than with the regular simulator doll**. At least, that's my opinion."*
- *"I think it gives us **great learning opportunities**. You **learn by doing and by getting feedback**, which is normally not often possible. It also offers us learning opportunities to **practice our communication skills** with the patient."*

**Testimonial from COACHES**

- *"Students behave **like they would behave with a real patient**, they are really in the scenario."*
- *"There are **great opportunities for the future**, it will be very beneficial for students to **get more chances to practice** without needing one of us present every time."*

# OUTCOMES

# DECISION SUPPORT IN CPS: AREAS OF INTEREST

**For trainers**

Understanding student behaviour better

Eliciting repeated issues with students

Establishing well-rounded training programme for each student

Insight into effective guiding practice

**For trainees**

Independent practicing in XR

Nudging towards certain desired behaviours

Insight into own behaviour

Debriefing based on authentic data

Any questions?
Thank you!