Pedagogical evaluation of an augmented reality thoracentesis simulator for medical student training

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Introduction

Thoracentesis or pleural puncture (PP) is a common invasive procedure, with many clinical indications, that can induce anxiety in both patients and healthcare professionals. However, when performed by a trained operator, the risk of complications remains minimal.
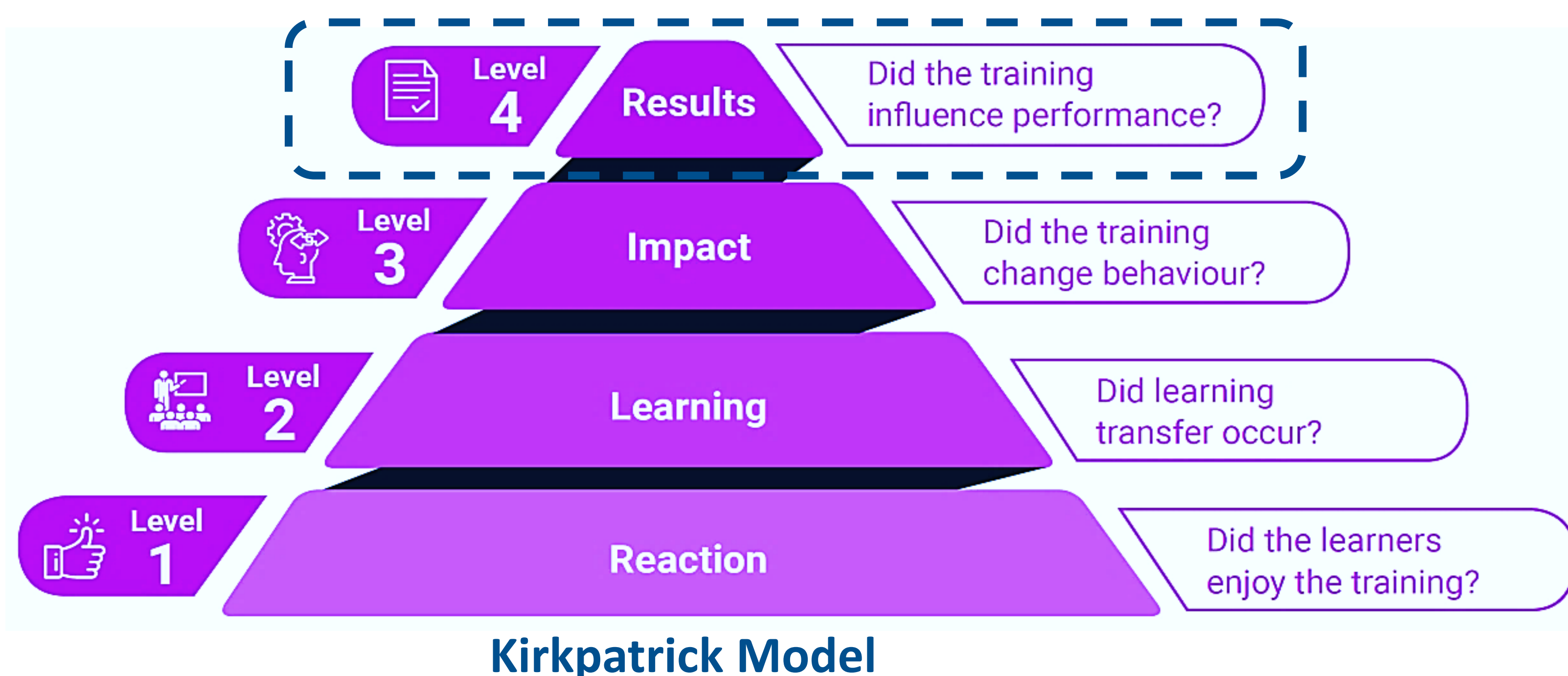
Teaching of thoracocentesis to medical students is usually made directly on the patient. Within the last years, new medical simulation tools have been developed, helping for student training, and to increase the safety and the comfort of the patients.

"Never the first time on a real patient"
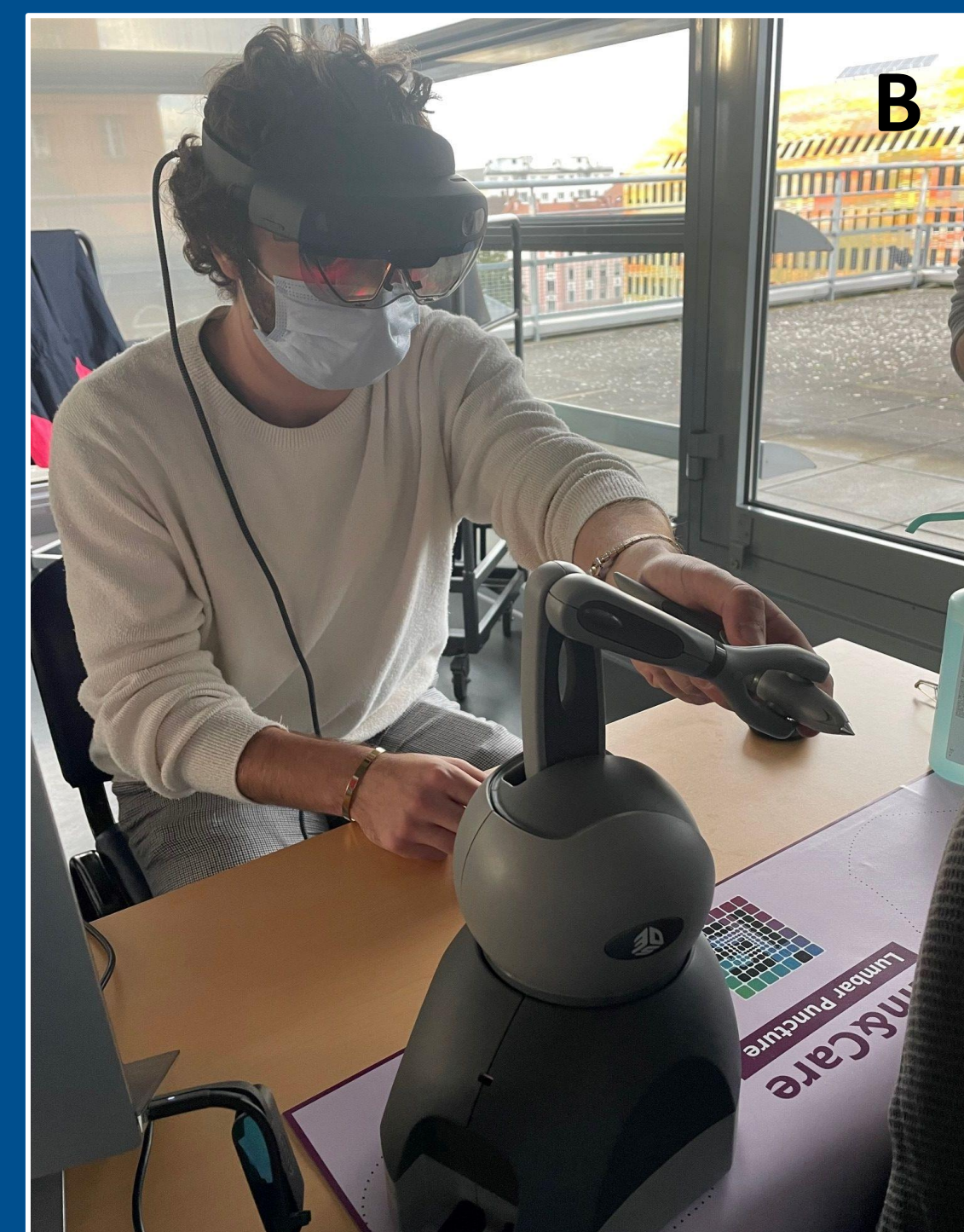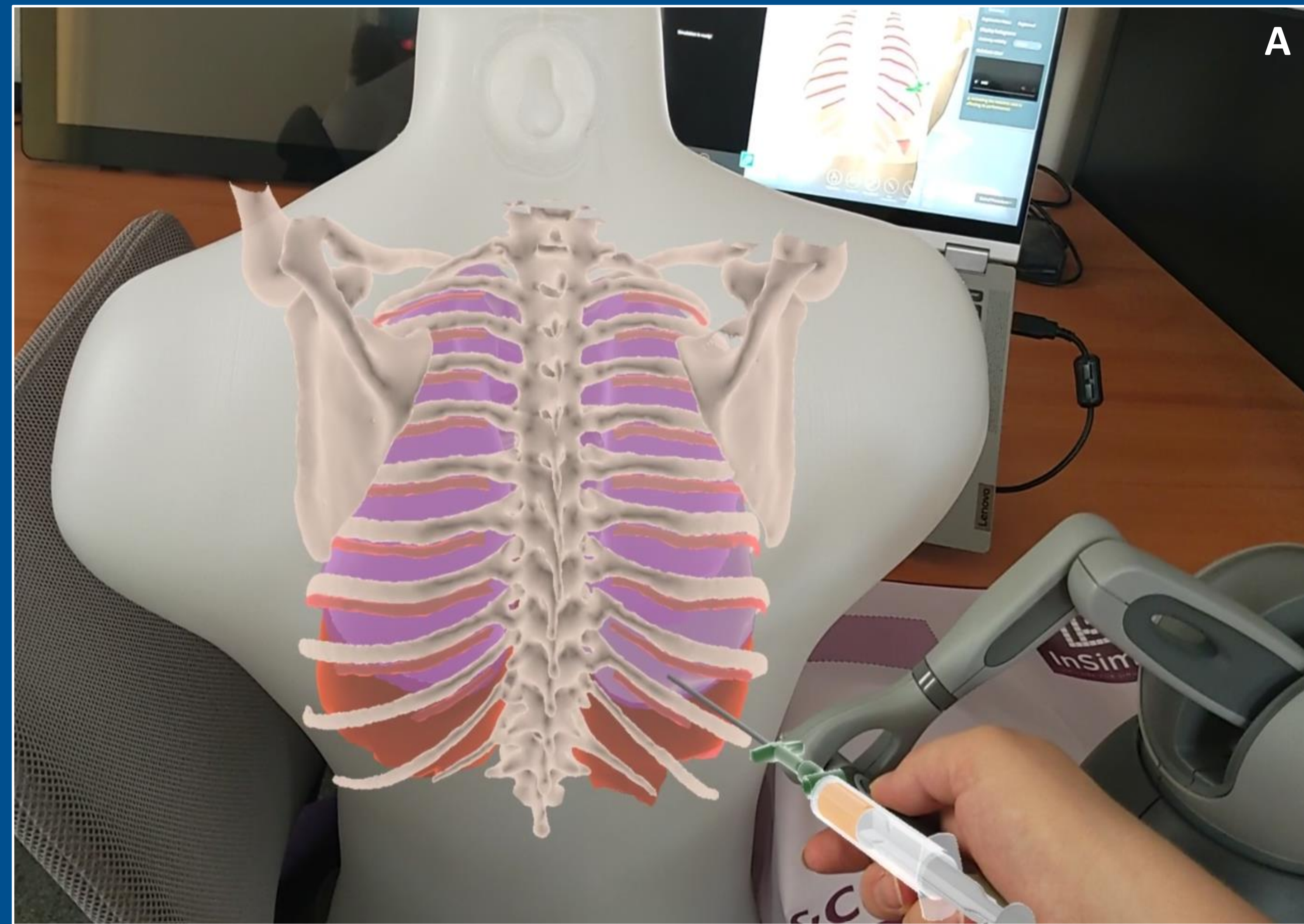
Simulator

It is important for these simulators to be realistic, user-friendly, and their educational value should be validated through clinical studies.

The Department of Respiratory Medicine at Strasbourg University Hospital, in collaboration with a local company, expert in the production of simulation devices, has developed an augmented reality thoracentesis simulator (Sim&Care). This simulator is integrated with a virtual reality headset, bringing realistic sensations to get through the different parietal structures of the chest wall, especially the skin and the pleura, with a haptic force feedback system.

Level 4 — Results: Did the training influence performance?
Level 3 — Impact: Did the training change behaviour?
Level 2 — Learning: Did learning transfer occur?
Level 1 — Reaction: Did the learners enjoy the training?

Kirkpatrick Model

▶ Dynamic view !

Figure : **A**. Augmented reality view with thoracentesis needle. **B**. Medical student in training. Virtual reality headset and articulated arm with haptic feedback. **C**. Simulation training session.
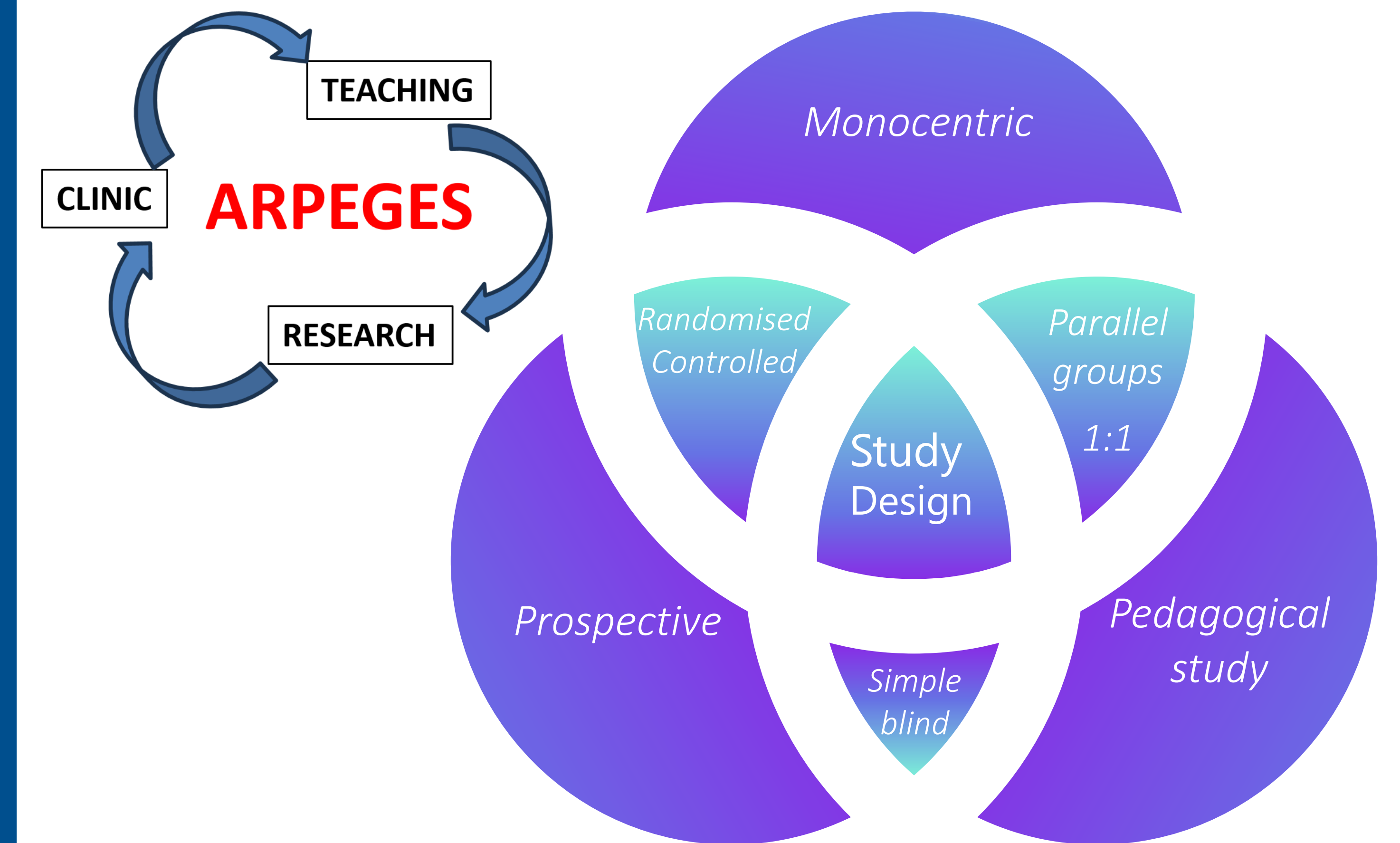
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No conflict of interest to disclose

Study protocol (ARPEGES)

The primary objective of our prospective randomized controlled study is to assess how the simulator may improve students' abilities to perform a <u>first pleural puncture</u> after a training with the simulator, compared to students who received a standard training in patient without any prior PP.

TEACHING — CLINIC — RESEARCH — **ARPEGES**

Monocentric · Randomised Controlled · Parallel groups 1:1 · Study Design · Prospective · Simple blind · Pedagogical study

This study was approved by the North-West III ethic committee.

Standard group	**Simulator group**
Classroom lecture (20 min) + Demonstration of a real PP (n=50)	Same + Simulator training session (2 hours) (n=50)

The simulation training sessions take place in our university simulation center (UNISIMES).

For this study, we selected a composite **primary outcome** :
• Successful PP with minimal assistance from the supervisor (oral advise)
• Successful PP with important help from the supervisor (manuel intervention)
• Failure (full supervisor intervention)

We also collected data (secondary outcomes) about the length of the PP, the anxiety felt by the student or patient during the PP, and then a simulator evaluation by students.

Inclusion rate on August 1st, 2024 : **40** students and **13** patients

The study began in January 2024 for 36 months. The first feedback from our students are really encouraging.

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