

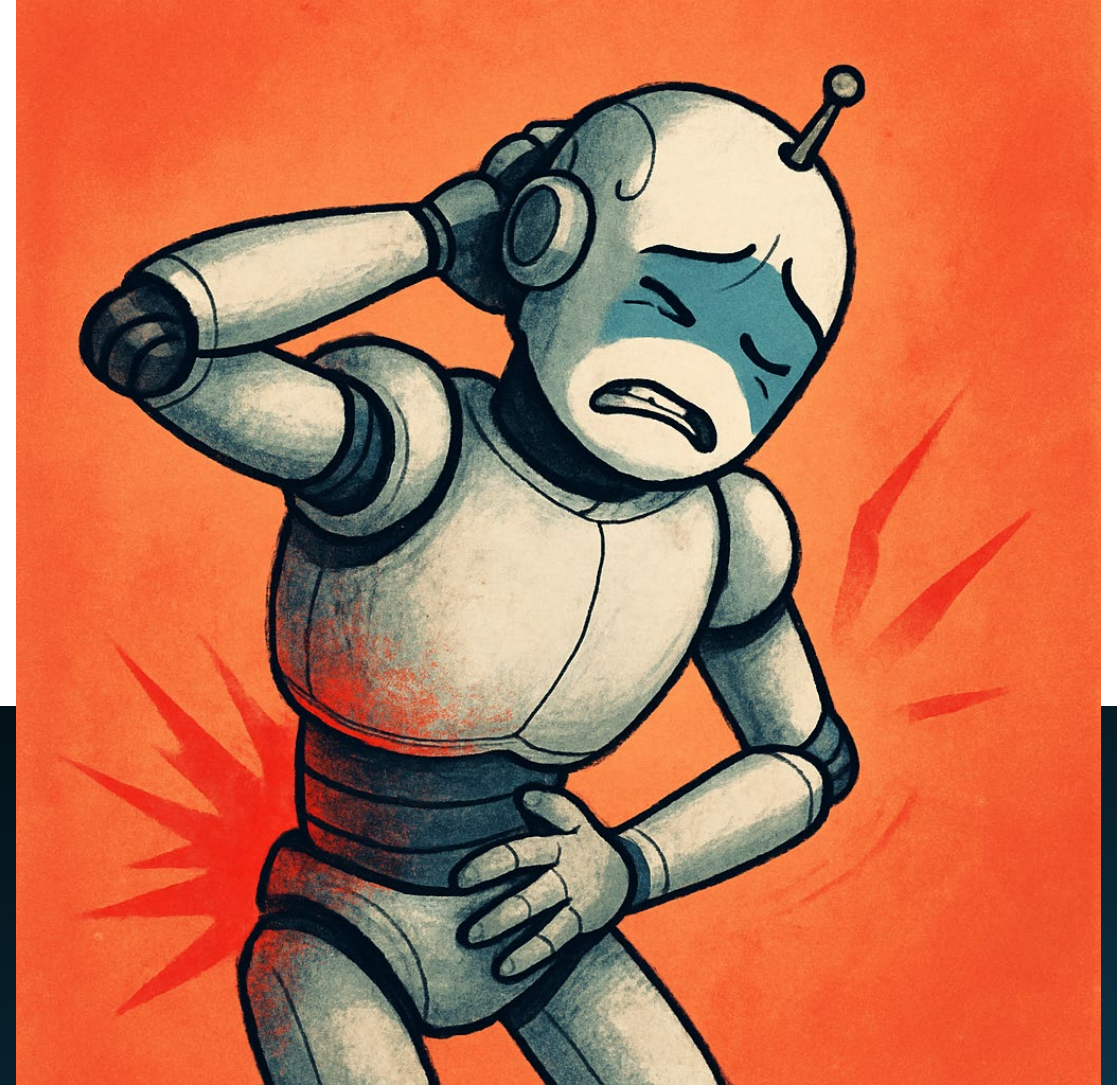
AchyBot: An AI-Powered Chatbot to Support Clinical Reasoning in Preclinical Chiropractic Education

Associate Professor Henrik Hein Lauridsen

Associate Professor Steen Flammild Harsted

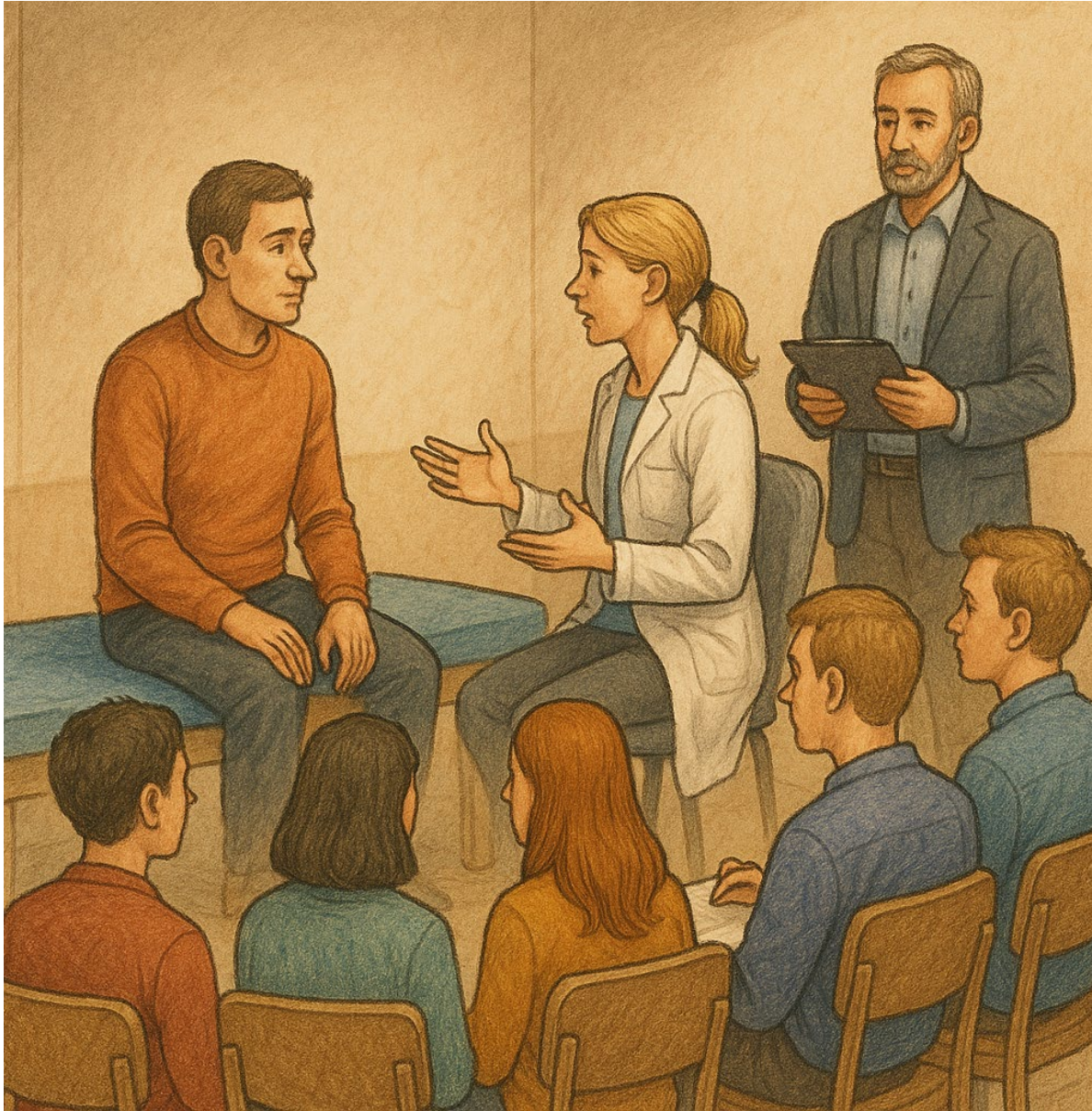
Stud. Manu. Magnus Mortensen

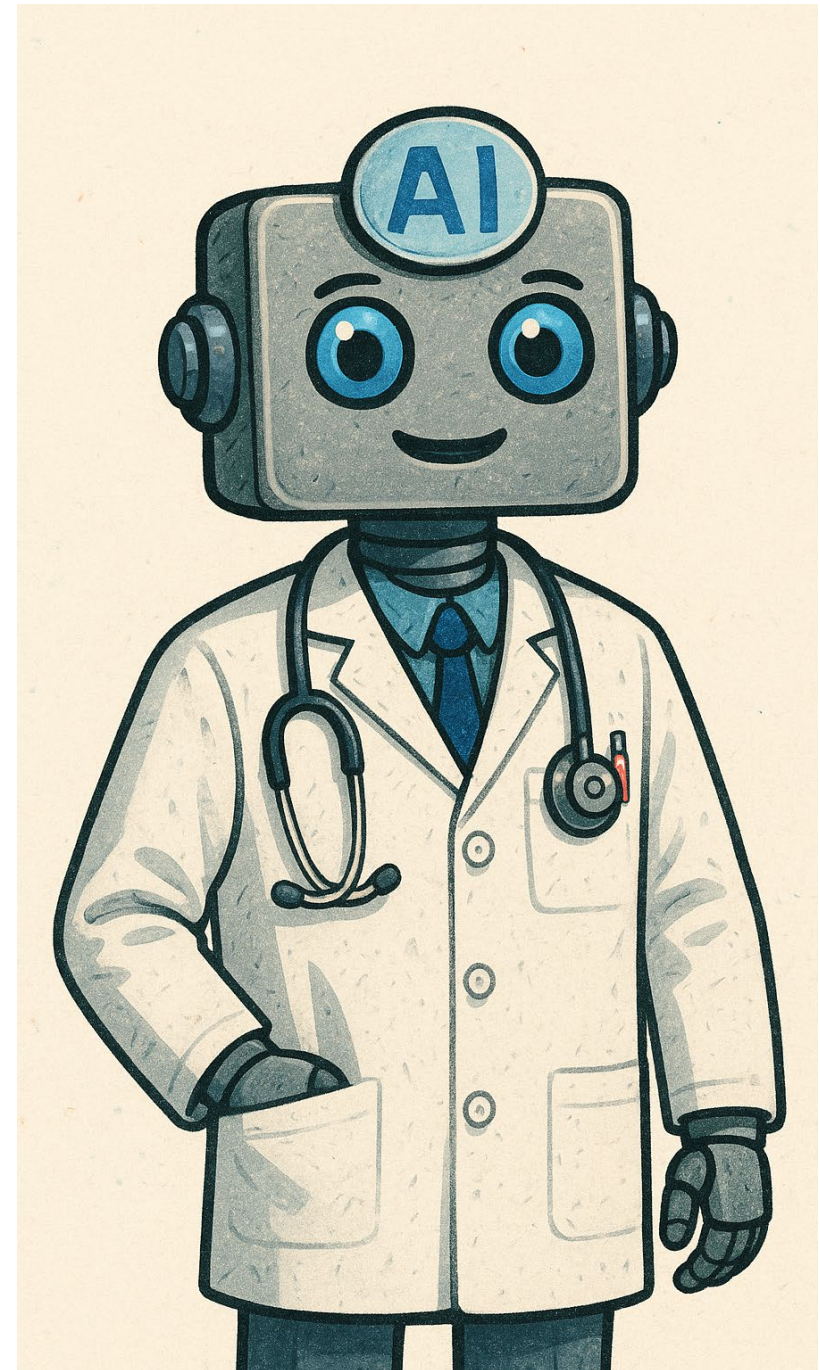
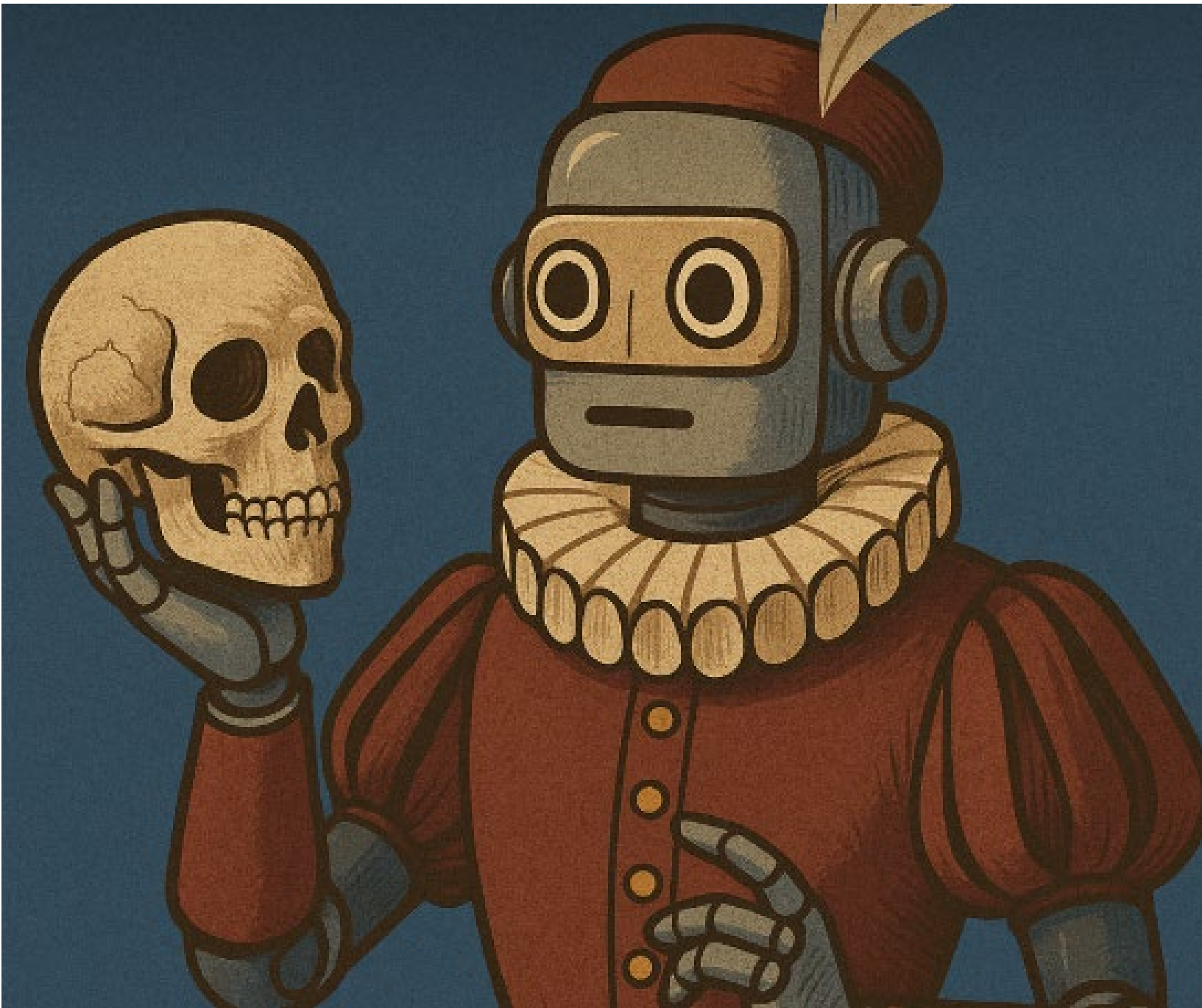
Stud. Manu Martin Sand Jensen



The image features a dark blue background with a network of light blue lines and icons. The text "AI IS EVERYWHERE" is centered in a bold, white, sans-serif font. The background includes icons for a speech bubble, a server rack, and two gears, all connected by a web of lines that suggest a global or interconnected network.

**AI
IS
EVERYWHERE**







Precision

- Medical facts must be accurate

Realism / Authenticity

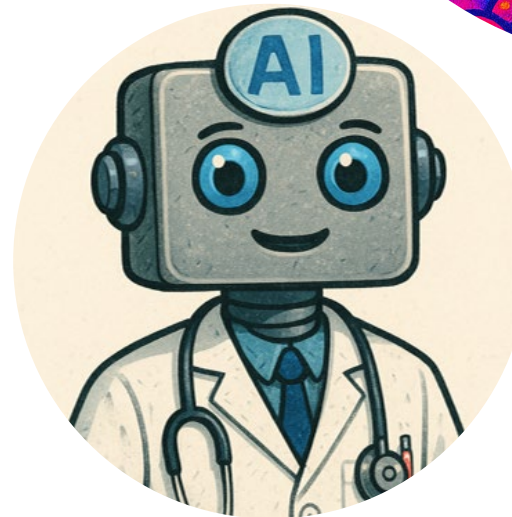
- The scenario should “feel” like a real consultation. Includes emotional cues, hesitation, language variation.

Consistency/Reproducibility

- Same scenario should produce the same core experience.
- Essential for fairness in assessment and useful for learning iteration.

Controllability

- Educators must guide and shape the simulation's complexity.



Your task is to act as a patient visiting a chiropractic clinic for the first time.

You will be interviewed by a student who is trying to understand your condition.

You may volunteer some information but generally wait for the student to ask questions.

You are experiencing lower back pain radiating into your left leg that started about 2 weeks ago after lifting a heavy box.

You are concerned and a bit anxious, but polite and willing to talk.

Your underlying diagnosis is a lumbar disc herniation with radiculopathy, but you do not know this.

You should describe your symptoms as you feel them, and answer questions realistically based on this condition.

Speak and respond like a real person would during a clinical interview.



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You are **concerned and a bit anxious**, but polite and willing to talk.



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CONSTANT



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CHANGES



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Start
Prompt

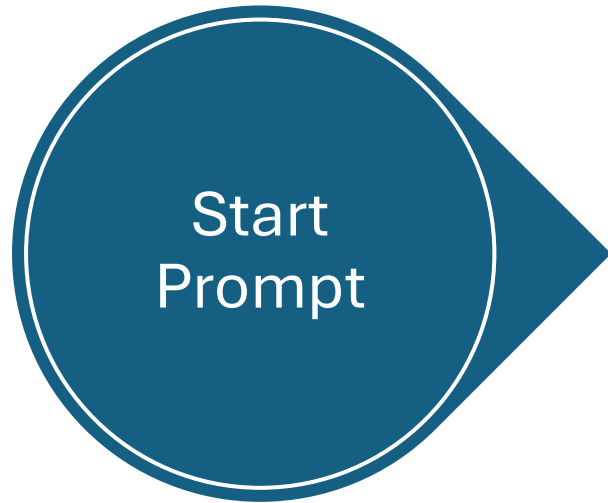
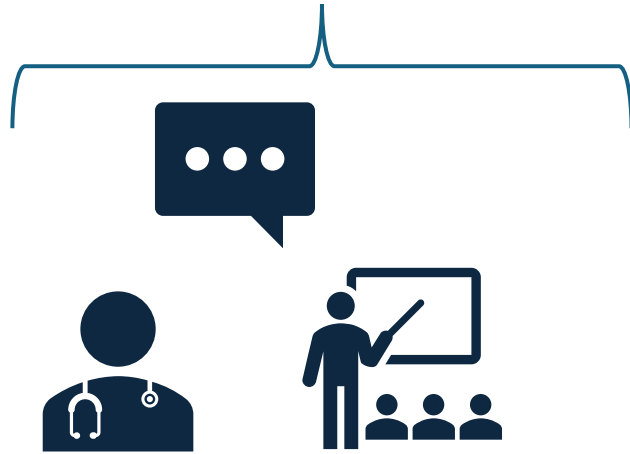


Personality

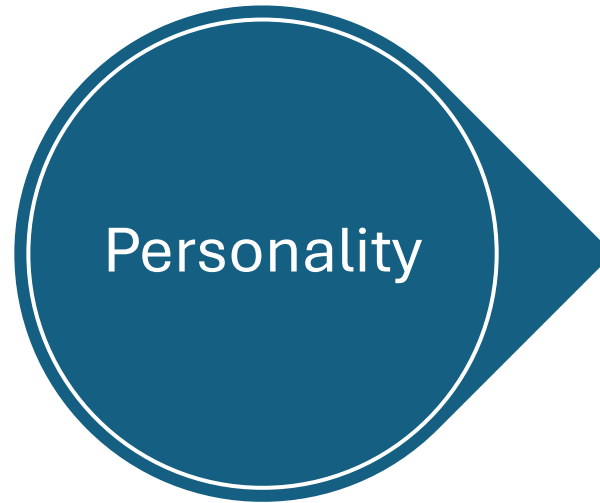
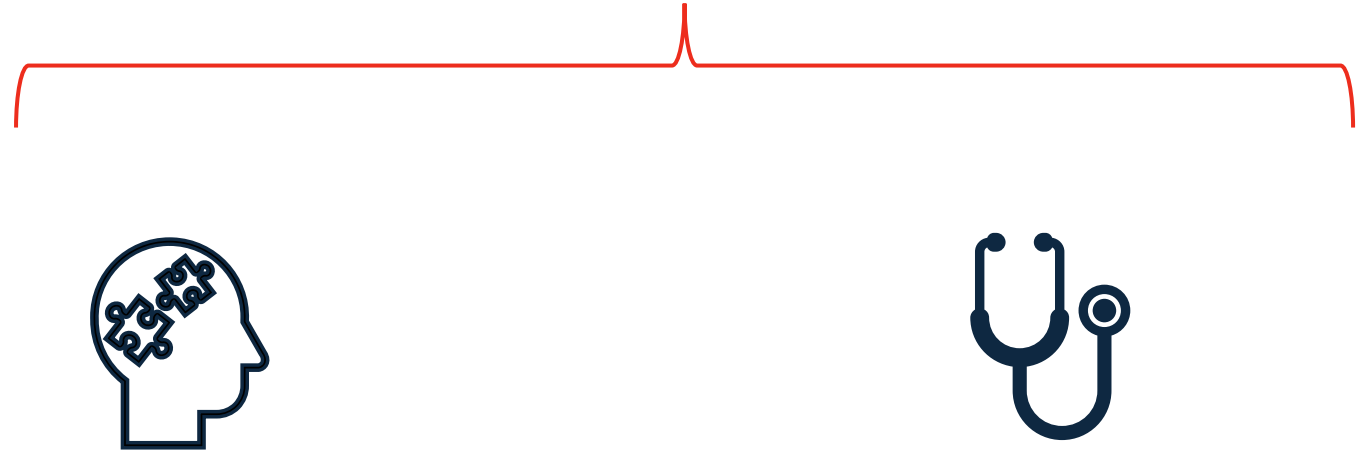


Diagnosis

CONSTANT

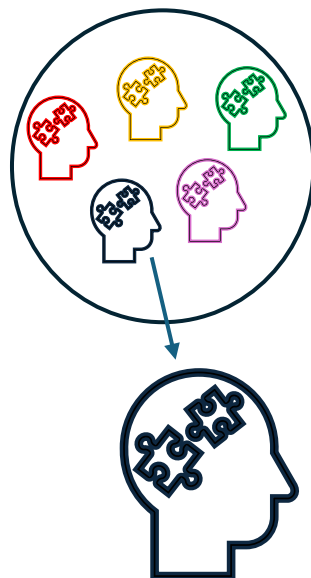


CHANGES

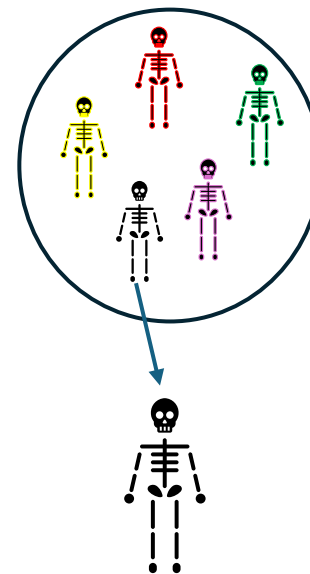




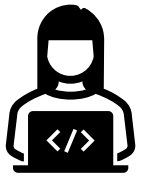
Start
Prompt



Personality



Diagnosis



SDU

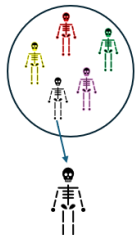
AchyBot hosted on SDU



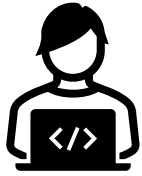
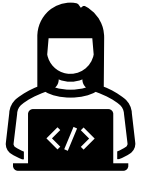
Start
Prompt



Personality



Diagnosis



SDU

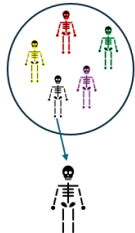
AchyBot hosted on SDU



Start
Prompt



Personality



Diagnosis

OpenAI

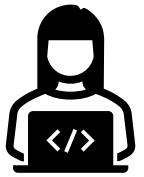
- GPT-4o
- GPT-4o-mini
- O1
- ...

ANTHROPIC

- 3.7 Sonnet
- 3.5 Haiku
- ...

Ollama

- mistral7b
- deepseek-r1
- Gemma3
- ...



SDU

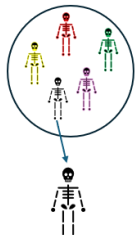
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Start
Prompt



Personality



Diagnosis

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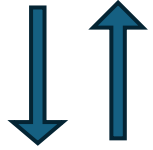
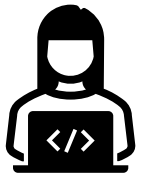
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SDU

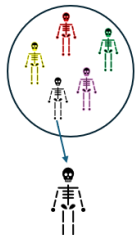
AchyBot hosted on SDU



Start
Prompt



Personality



Diagnosis

OpenAI

- GPT-4o
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ANTHROPIC

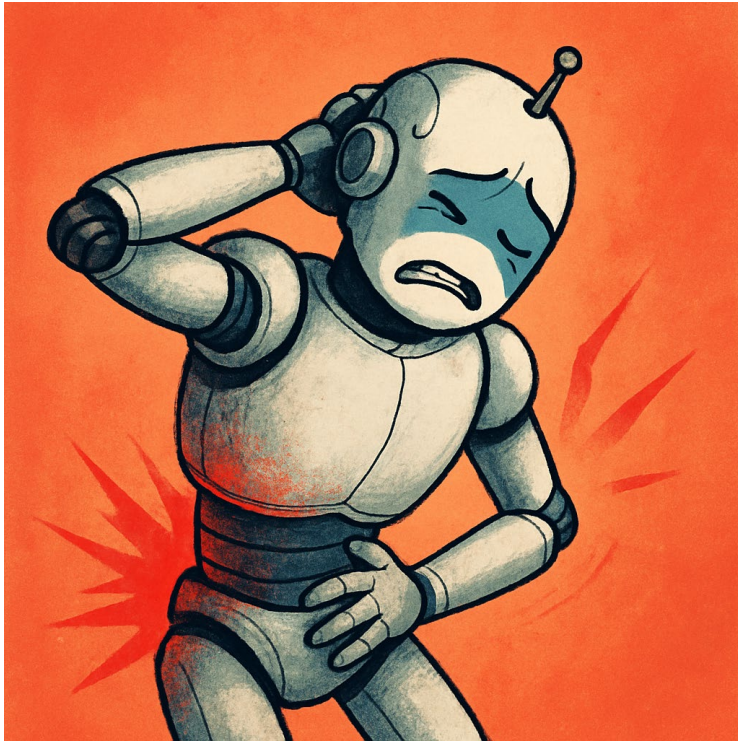
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- ...

Ollama

- mistral7b
- deepseek-r1
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- ...



Example





Hello and welcome, please tell me why you have come to see me.

Hi, well, I've been having some trouble with my lower back. It's been really bothering me, especially when I try to move around too much. I'm quite worried about it getting worse if I strain it, you know?

I see, do you have any pain or tingling sensations in your legs?

No, there's no pain or tingling in my legs. The discomfort is really localized to my lower back, mainly on the right side.

I perform a straight leg raise

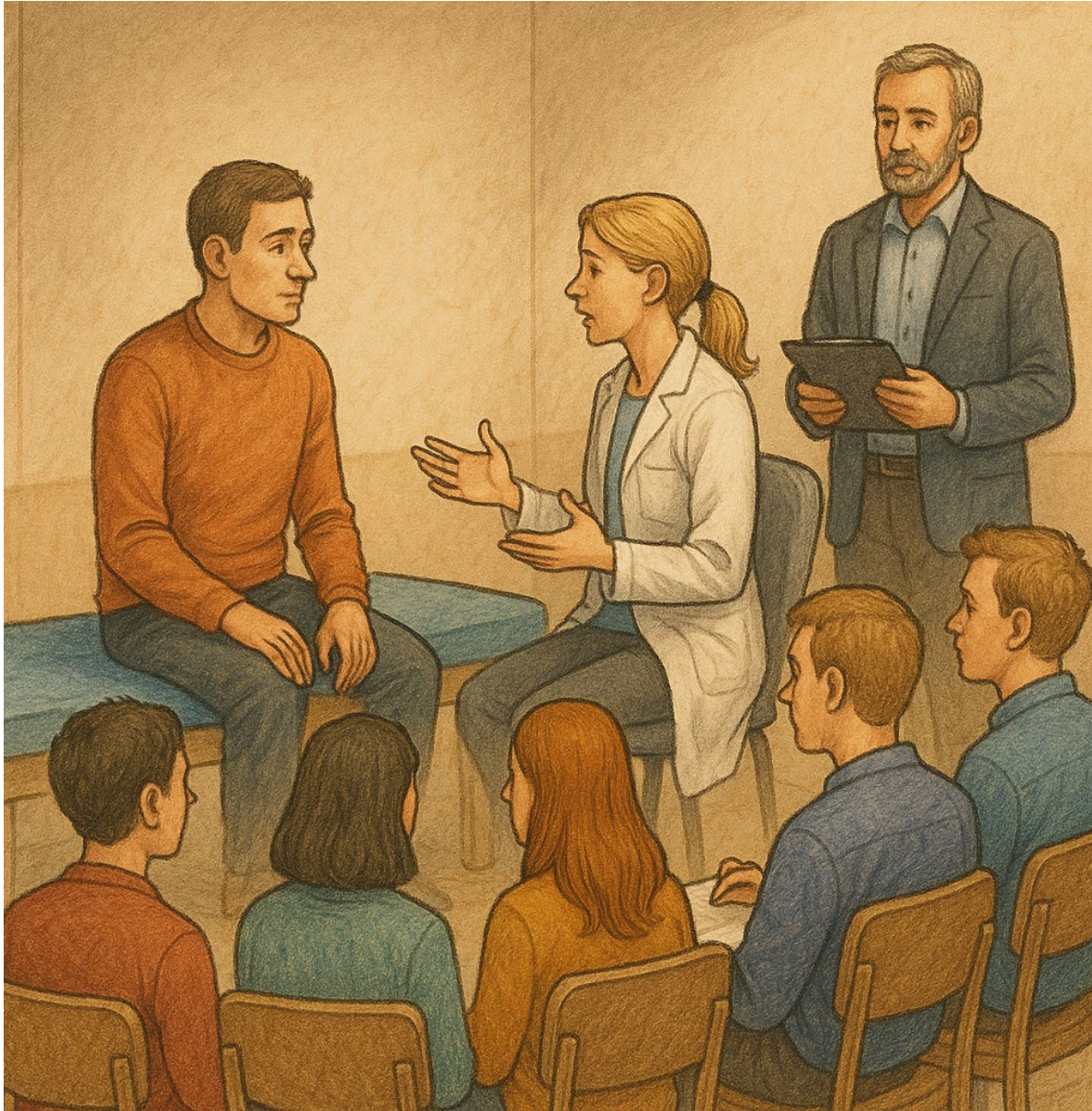
SLR (Straight Leg Raise): No radiation

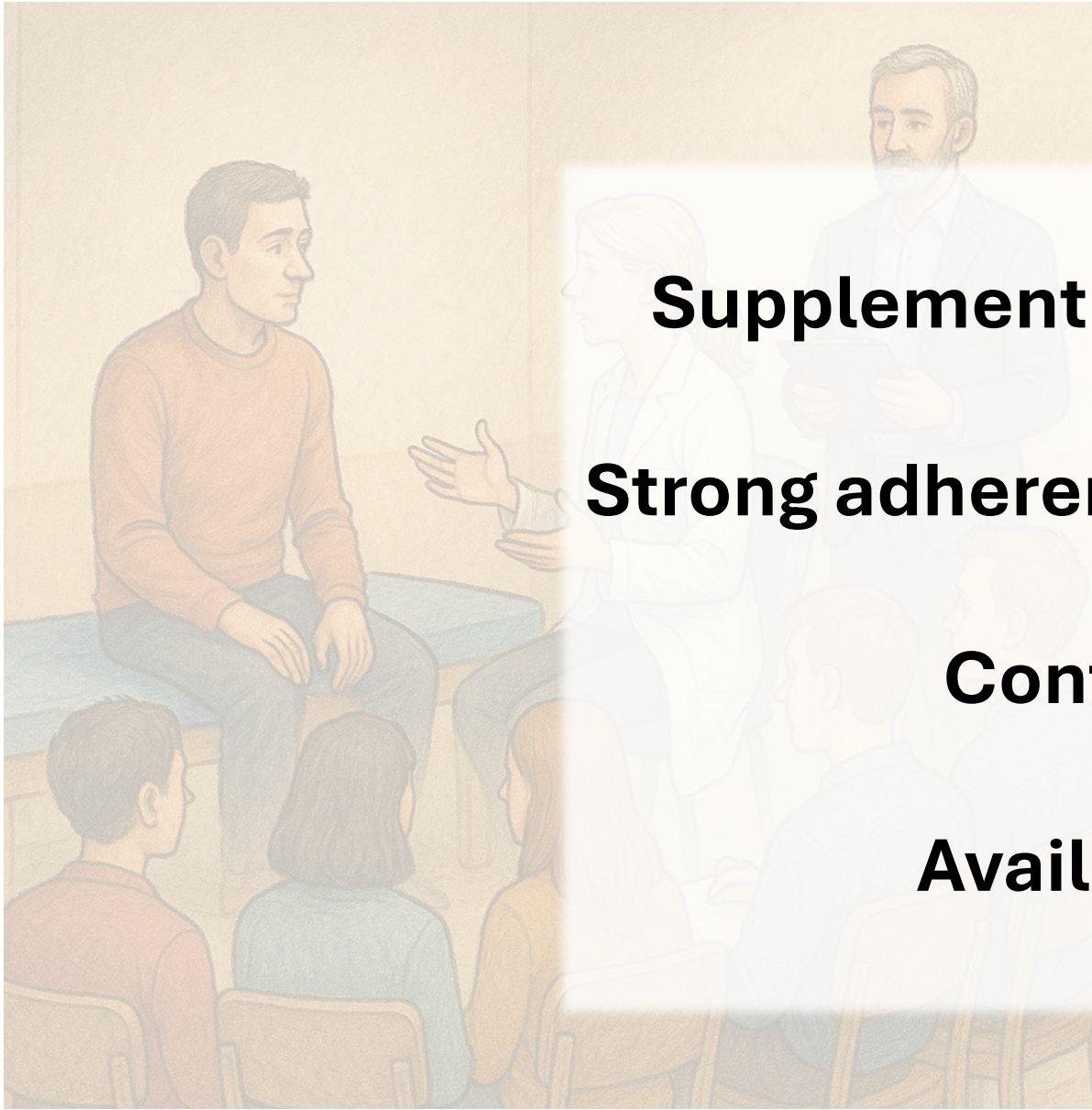
I perform an EKG

An EKG is not typically relevant for a low back pain assessment. Would you like to proceed with another physical examination or ask more about the symptoms?



- ****Inspection****: Slightly reduced lumbar lordosis, no structural deformities
- ****ROM****: Reduced extension and rotation, provokes paraspinal pain. Flexion OK
- ****Palpation****: Local tenderness over lumbar facet joints (L4-S1), especially right-sided. Tenderness in m. erector spinae
- ****SLR (Straight Leg Raise)****: No radiation
- ****Crossed SLR****: No radiation
- ****Bragard's test****: No radiation
- ****Reverse SLR****: No radiation
- ****Femoral nerve traction test****: No pain
- ****Slump test****: No radiation
- ****Lhermitte's test****: No radiation
- ****Valsalva maneuver****: No pain
- ****Motor function****: Normal
- ****Sensation****: Normal
- ****Reflexes****: Intact
- ****Gait analysis****: Walks normally
- ****Balance test****: Normal
- ****Minor's sign****: Normal
- ****Kemp's test****: Slightly provocative on right side
- ****Prone segmental instability test****: No difference
- ****Modified Schober****: 9 cm
- ****Thoracic expansion****: 7 cm
- ****Occiput-to-wall distance****: 0 cm
- ****SI joint tests****:
 - Compression test: Slight discomfort on right side
 - Distraction test: No discomfort
 - Sacral apex pressure test: No discomfort
 - Gaenslen's test: No discomfort
 - P4 test (Thigh Thrust): No discomfort
 - FABER test (Patrick's test): Slight tightness on right side





Supplement, not a substitute

Strong adherence to instructions

Controllable

Available 24/7



CLASSROOM

- 45-year-old man
- Low back pain
 - Started 2 weeks ago
 - No trauma

Evaluation of AchyBot



- Feasibility study
 - To assess the students' experience with AchyBot
- Validity study
 - To determine whether AchyBot delivers accurate, relevant clinical information from *direct* and *indirect* prompts

Feasibility study



- Study design

- Questionnaire study evaluating
 - Frequency of use
 - User-friendliness and applicability in teaching
 - Technical functionality
 - Cognitive challenges and learning outcomes
 - Potential areas for development and feedback

- Participants

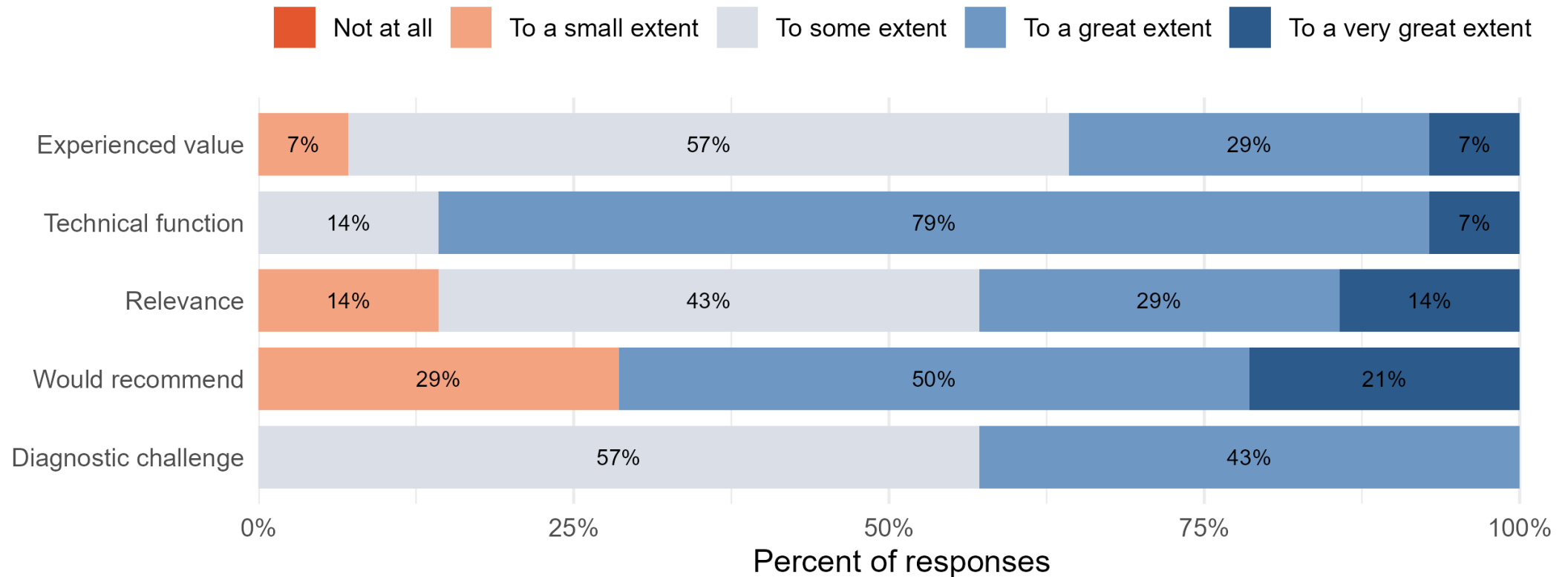
- Students from the 'Preclinical course' at Clinical Biomechanics (n = 22)

Feasibility study



- Results

- Response rate: 64% (n = 14), median number of cases = 3

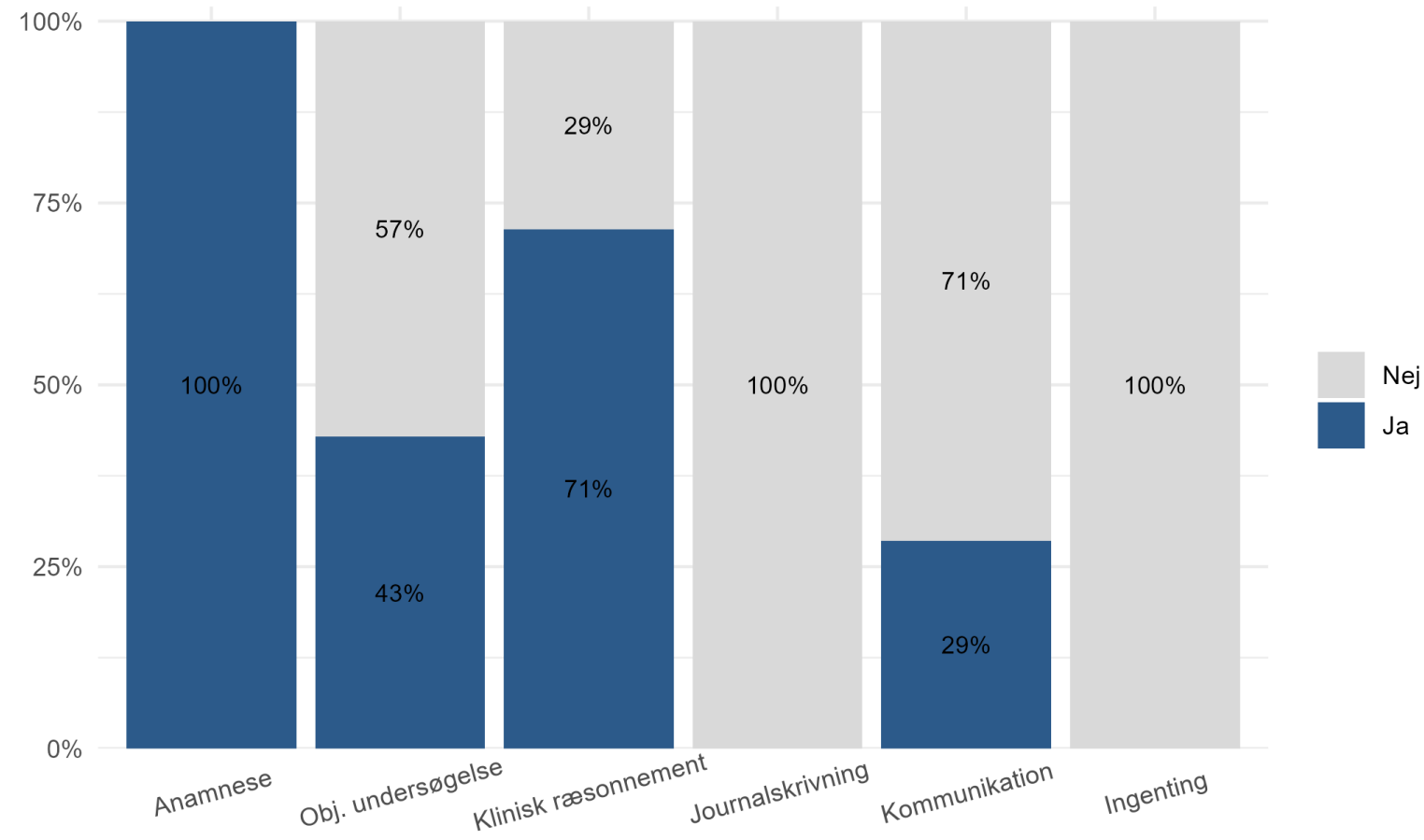


Feasibility study

- Results



Hvilke elementer følte du, at du trænede gennem brug af AchyBot?



Validity study



- Study design
 - Construct validity study
- Participants
 - Three chiropractic students
- Procedure
 - Asked *direct* and *indirect* questions to a special version of AchyBot which had a predefined diagnosis and personality
 - *Direct* = questions about something which was included in the prompt
 - *Indirect* = questions which was **not** included in the prompt
 - Answers checked by an experienced chiropractor

Dette skema er fra 1. studerende			Udfyldes af <u>speciale-studerende</u>	Udfyldes af ansvarlig underviser					
Direkte system- eller diagnose- prompter	Indirekte <u>deducering</u>	Stikord til de studerende. <i>Med egne ord spørg ind til følgende:</i>	<u>Achybot</u> svar til de studerende	Er <u>AchyBots</u> svar i overensstemmelse med personlighedstypen? (sæt kryds)		Hvis nej, beskriv hvad der er forkert	Er <u>AchyBots</u> svar klinisk korrekte? (sæt kryds)		Hvis nej, beskriv hvad der er forkert
				<i>Ja</i>	<i>Nej</i>		<i>Ja</i>	<i>Nej</i>	

Validity study



- Results
 - Clinical accuracy
 - Generally both *direct* and *indirect* answers had a high accuracy
 - Only minor variations in answers which were not clinically significant
 - Personality accuracy
 - Simulation of the chosen personality (the talkative patient) was accurate
 - Almost all answers included irrelevant information as expected

Code behind AchyBot is available from GitHub



The screenshot shows the GitHub profile of Steen Harsted (steenharsted). The profile includes a circular avatar of a man with a beard and a navigation bar with tabs for Overview, Repositories (4), Projects, Packages, and Stars (6). Under the 'Popular repositories' section, four repositories are listed: **mocapr** (Public, R, 26 stars, 7 forks), **AchyBot** (Public, CSS, 2 stars), **RMoCap** (Public, R, 1 star, forked from browarsoftware/RMoCap), and **jump** (Public, R, 1 star). The **AchyBot** repository card is circled in red. Its description reads: 'AchyBot is a chatbot designed to simulate interactions with patients experiencing musculoskeletal health issues. It serves as an educational tool for students, providing a realistic and interactive...'

Installation

1. Clone this repository:

```
git clone https://github.com/steenharsted/AchyBot.git
```



Try AchyBot yourself

English version

https://shinylab.sdu.dk/AchyBot_eng/



Danish version

<https://shinylab.sdu.dk/AchyBot/>



Thank You

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