Python seminar

# The role of LLMs (and other tools)

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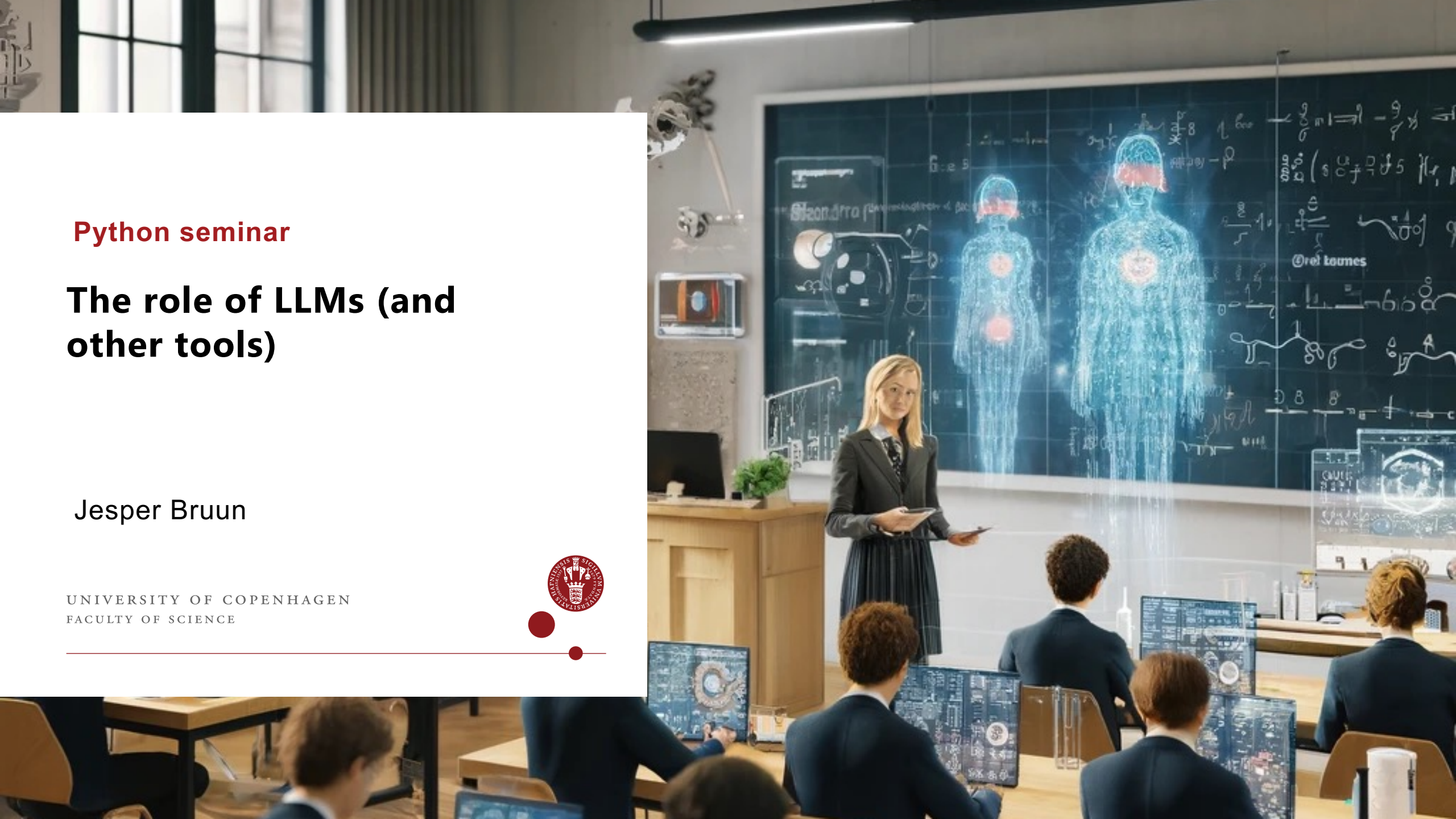
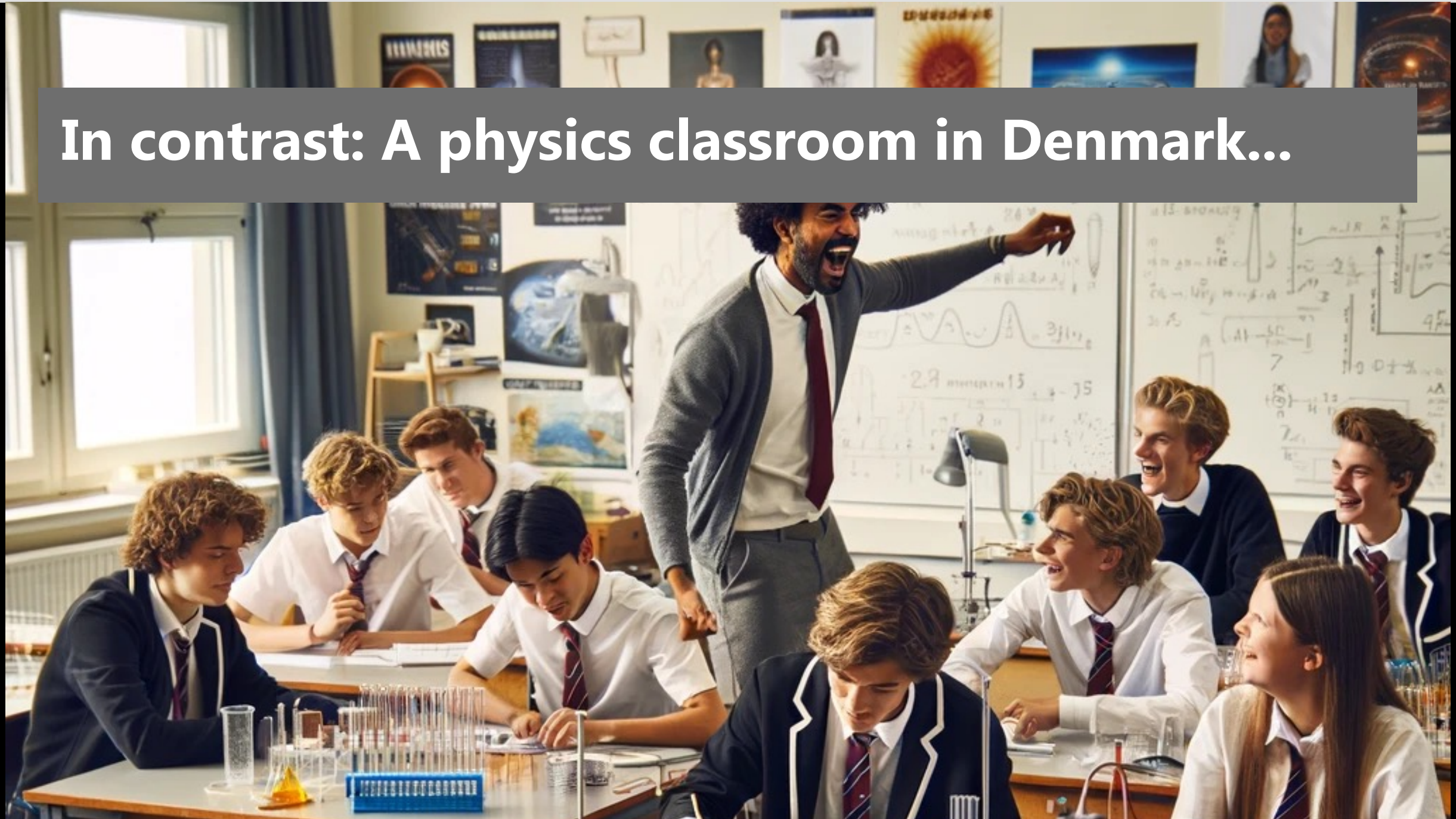


# In contrast: A physics classroom in Denmark...



# LLMs in Programming education

- LLM performance in exams for beginners (Denny et al 2023)
  - Asked Copilot to solve all questions from two Python CS1 exams
  - It solved almost 50% of the problems on its first attempt
  - Copilot "got" 78.5% on Exam 1 and 78% on Exam 2 (rank 17/71)
- Instructions opinions: a nonrepresentative survey (Lau & Guo 2023)

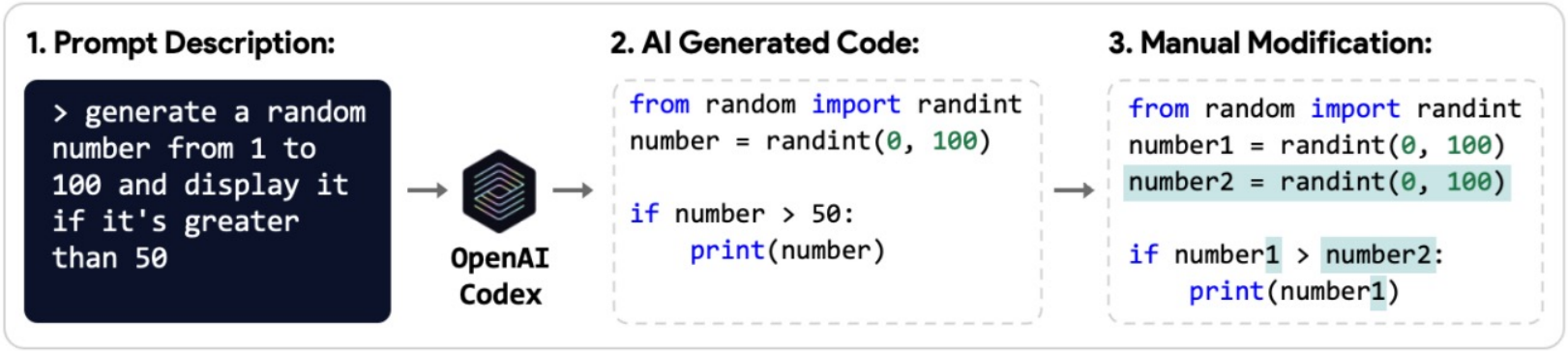
A. Resistance to using LLMs in teaching
  - Instructors are concerned about the efficiency of learing
  - Countermeasures: AI proof assessments, proctored exams

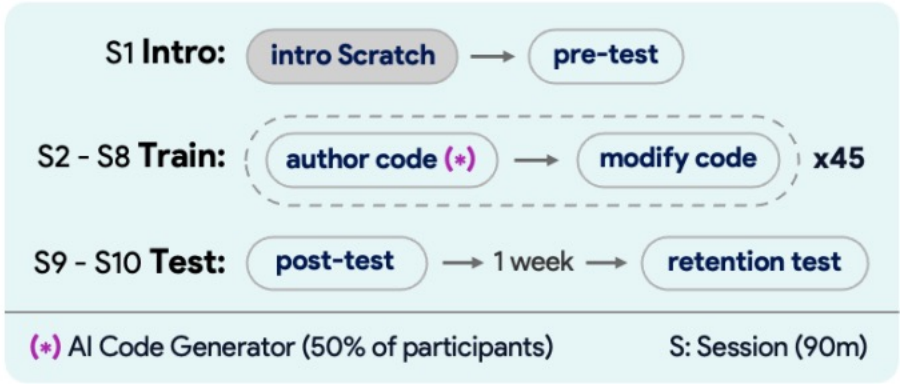
B. Embracing AI tools by integrating them in teaching
  - Focus on code reading and critical thinking
  - Encourage students to use AI tools for learning

Based on slides by Andrzejak 2024

# LLMs Potential Benefits in Prg. Education

- Novices (n=69), age 10-17, were asked to complete 45 Python tasks
- Each task consisted of a code authoring followed by a code modification part

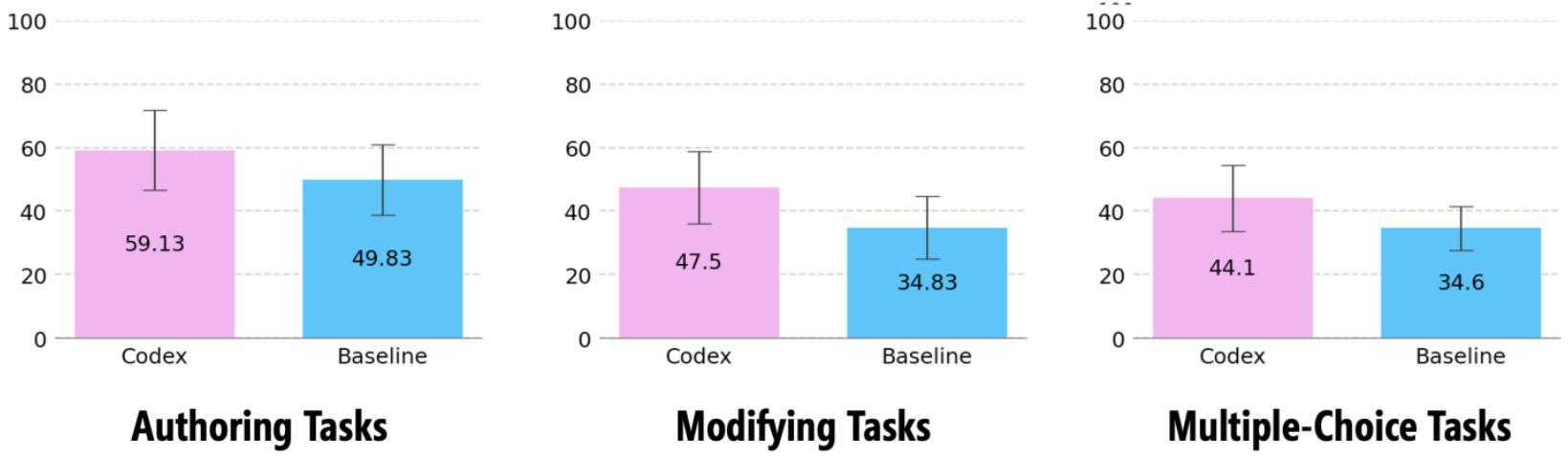



Andrzejak 2024

# LLMs Potential Benefits in Prg. Education

- Retention posttest (1 week later): authoring, modification, multiple choice questions (see Kazemitabaar et al 2023)




- Students in the Codex (LLM) group reported being more eager to learn programming and felt less stressed, discouraged, and irritated while completing the tasks than those without Codex

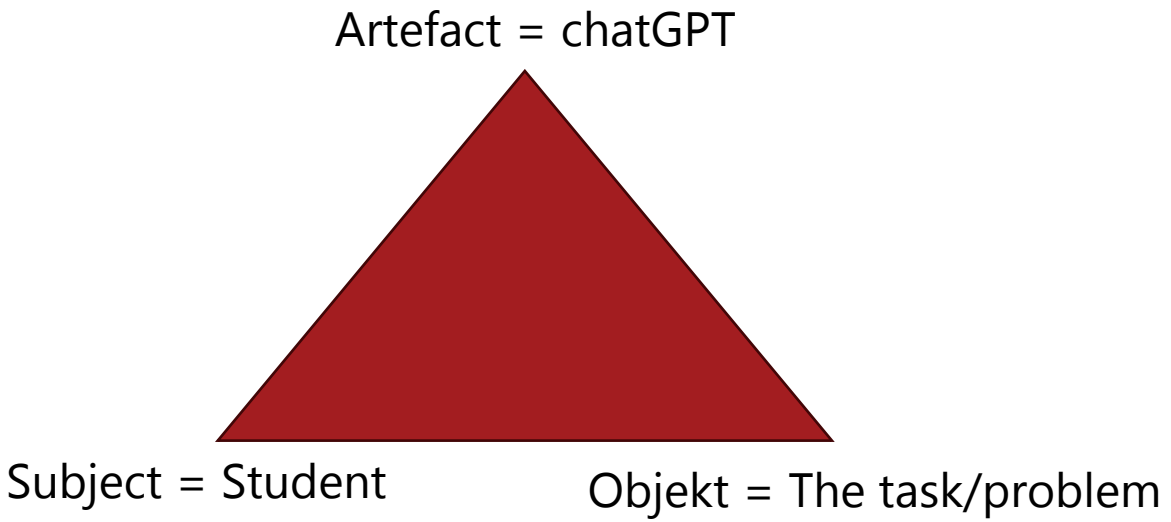
Andrzejak 2024

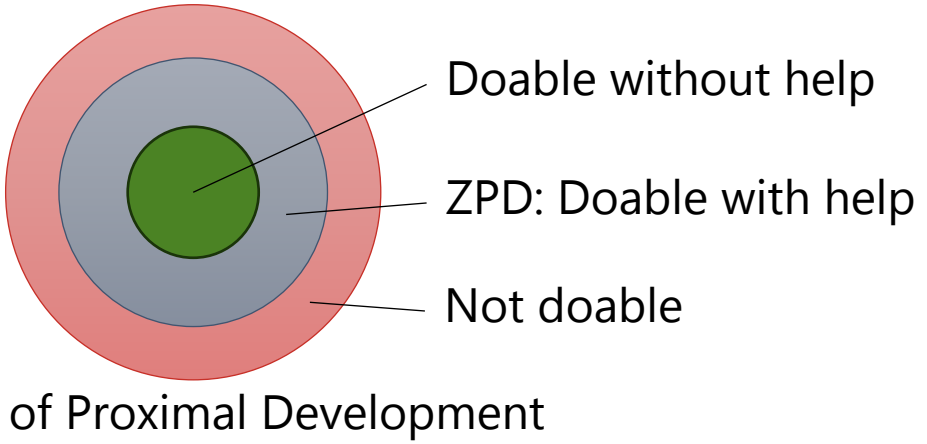
# Some theoretical thoughts

- Necessary to think about the change in our understanding of competencies to use AI productively
- Necessary to think about how we can teach them these competences
- Thus, also teacher training
- Generally, rethink educational tasks (for instance have the classroom work as a team to solve a difficult problem)
- Now, some thoughts about that from two big lines of thinking in science education research: sociocultural perspectives and cognitive perspectives

# Student use of AI – a Vygotskian angle

- End-goal of teaching: mastery of cultural symbols and structures (Dolin 2017, p. 191)
- Knowledge: Between people -> into the person
- Internalization through mediation
- ZPD: Problem solving with the help of an adult or capable peer
- Should we see ChatGPT as a "capable peer", an artefact or both?
- Will affect internalization proces – how students learn

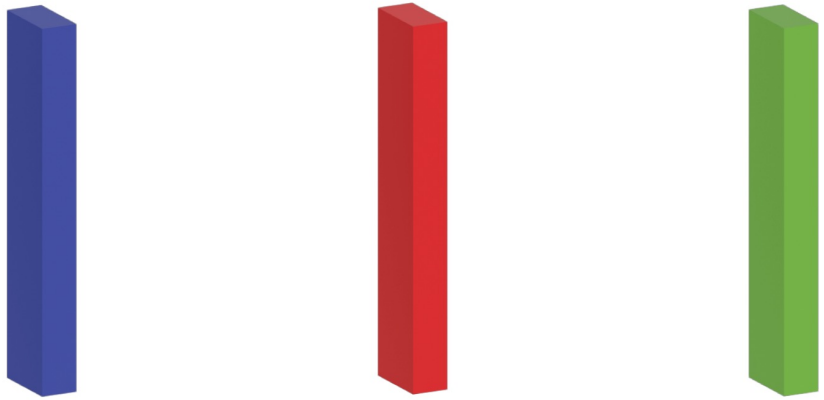


# Student use of generative AI – a Piagetian angle

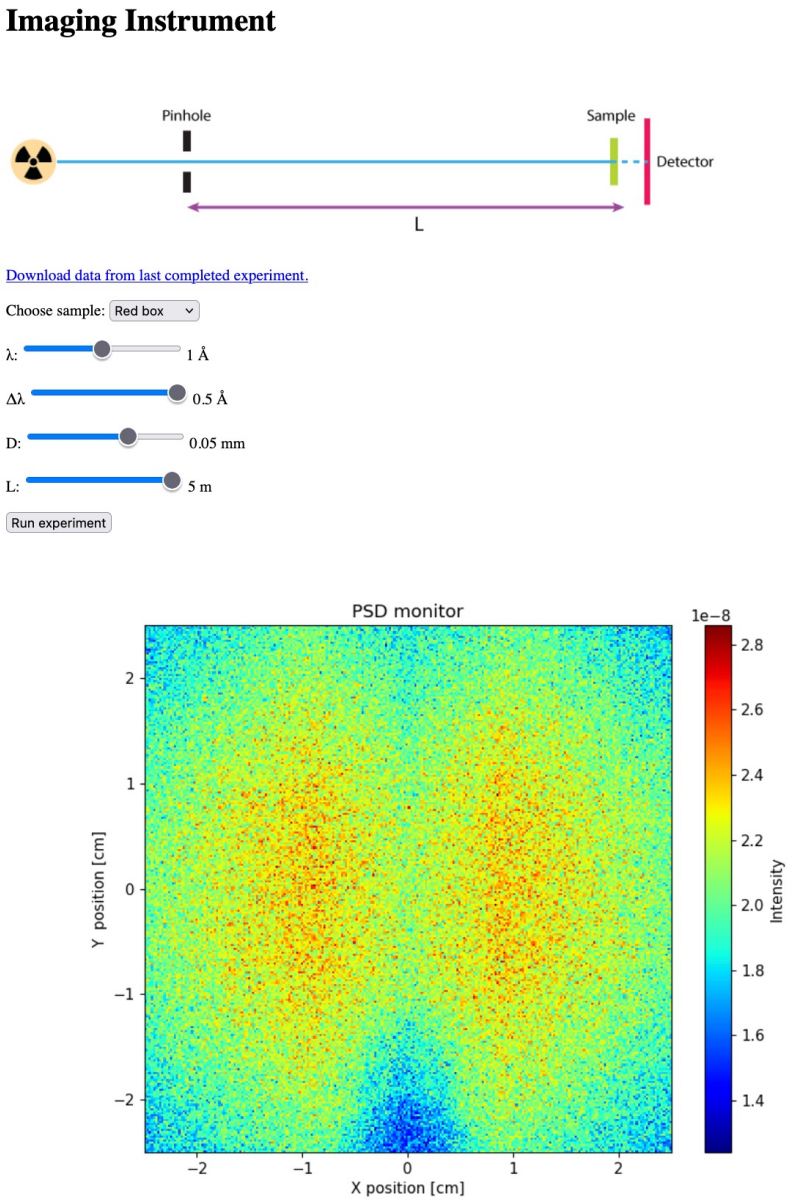
- Assimilation og accommodation of knowledge by changing schemata
- Accommodation initiated by a cognitive disturbance causing the mental system to become unbalanced (one wonders)
- It could be due to getting a result one did not expect
- The student may not respond to this unbalance and push aside any wonderment (Dolin 2006)
- But the student should be careful with that strategy when using ChatGPT.
- So, perhaps we can use this opportunity to teach and give opportunity for our students to wonder
- Need to analyse the actual interactions!

# From a physics teaching unit



- Three (virtual) mystery boxes
- Lead on the outside
- Something else on the inside
- Students need to figure out what is on the inside

Use virtual experiments



# The Race to Space Helper (show)

Race to Space helper

How do we analyse our data in excel?

To analyze your data in Excel, let's start by importing and visualizing it. Here's a step-by-step guide:

1. **Import Data**:
   - Open Excel and go to `File > Open`.
   - Select your CSV file (e.g., SANS_Qq_2.0_0.2_0.004_1.0_1.0_1.0_1.0_blueVial.csv).
2. **Data Cleaning**:
   - Ensure your data is correctly formatted in columns.
   - Check for and remove any irrelevant or missing data points.
3. **Plotting Data**:
   - Select the columns you want to plot (e.g., Q and Intensity).
   - Go to `Insert > Scatter Plot` to visualize the data points.

# LLMs for learning – Inquiry Bots

Can LLMs learn to do as good teachers do? At least to some extent?

If so, then this could benefit students

Patient GPT and no judgement from teacher and classmates

# THE INQUIRY PHYSICS TEACHER BOT FOR E-M

Trained with prompt, examples, and even extra literature.

We now have a version that we think does some of the right things

Find examples on the padlet (QR->)

Choose one example, and see how you like it

Work by Filomela Avdi

# Discussion questions

- Can we make a "dialogical programming GPT" – i.e. a GPT that behave as a good teacher?
- Should we?