

The background of the entire image is a close-up photograph of several fingers. The tips of the fingers are wrapped in marbled paper with vibrant, swirling patterns of red, yellow, blue, green, and black. The background behind the fingers is a solid, dark teal color.

# Open Research Day

9 April 2025



“

**09:55-10:25**

*Parallel Sessions- lightning talks followed by  
breakout session*

**A108: Social AI**

Chair: Associate Professor Iolanda Leite, KTH

**A123: Transforming  
Education**

Chair: Associate Professor Olga Viberg, KTH

# A123: Transforming Education

- **Lightning talk: Session chair: Associate Professor Olga Viberg, KTH**

1. Empowering Cultural Integration and Language Learning through Conversational AI (Demo)
2. Semi-automated math tutoring (Demo)
3. Transforming Engineering Education with Multimodal GenAI and Intelligent Agents for Improving Problem-Solving Skills (RP)

# Empowering Cultural Integration and Language Learning through Conversational AI

Alireza M. Kamelabad  
KTH Royal Institute of Technology  
Division of Speech, Music and Hearing





# Project team



**Alireza M. Kamelabad**

PhD Candidate, KTH

M.Sc. Cognitive Science  
(Language and multimodal  
Interaction)

M.A. Human-Computer Interaction



**PI: Gabriel Skantze**

Professor, KTH

20 years of research on  
conversational systems

Co-founder/Chief Scientist of  
Furhat Robotics



**Co-PI: Ali Reza Majlesi**

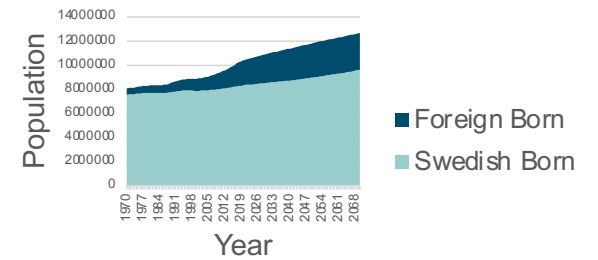
Associate Professor, SU

Sociocultural and interactional  
perspectives on social interactions

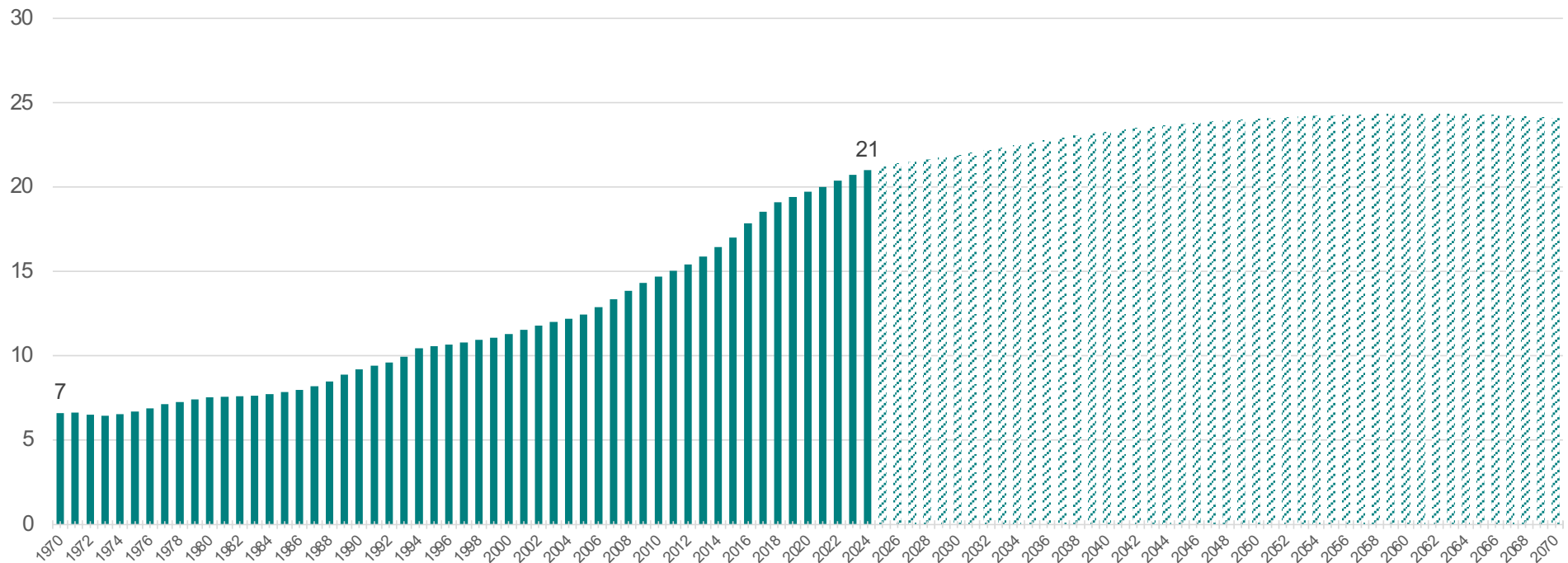
Second language acquisition,  
classroom interactions and  
teaching and learning processes

# Problem

Sweden's Population



Immigrant/total population ratio



# Project's Vision

## A New Approach to Language Learning



Innovative use of social robots & virtual agents



User-centered design with participatory approach



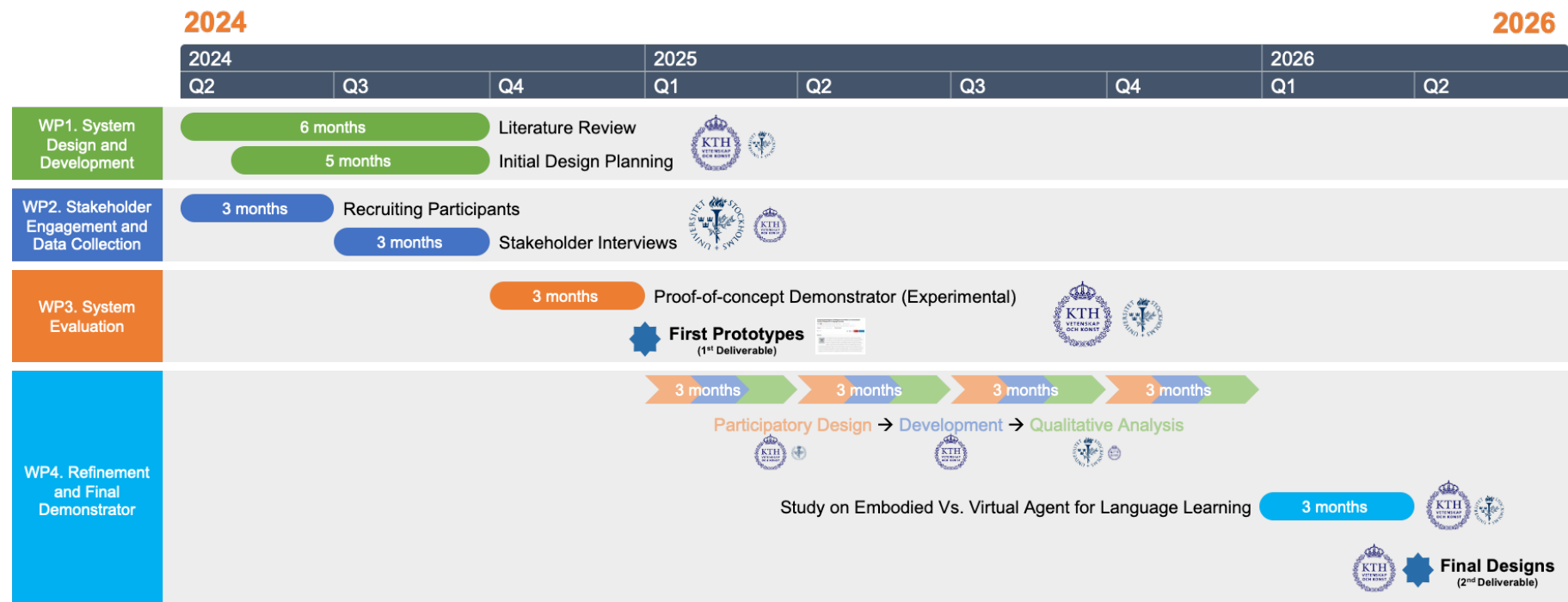
Objectives: Prototyping Embodied conversational agent & Virtual voice assistant



Assess and compare the effects of these technologies on learners language development

# Prototype Swedish Conversation Practice through Conversational AI

- A Longitudinal Study
- Collaboration with SFI





# Comparing Monolingual and Bilingual Social Robots as Conversational Practice Companions in Language Learning

Authors:  Alireza M. Kamelabad,  Elin Inoue,  Gabriel Skantze | [Authors Info & Claims](#)

HRI '25: Proceedings of the 2025 ACM/IEEE International Conference on Human-Robot Interaction • Pages 829 - 838

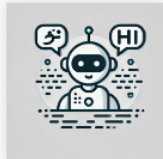
Published: 04 March 2025 [Publication History](#)

 Check for updates

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## Abstract

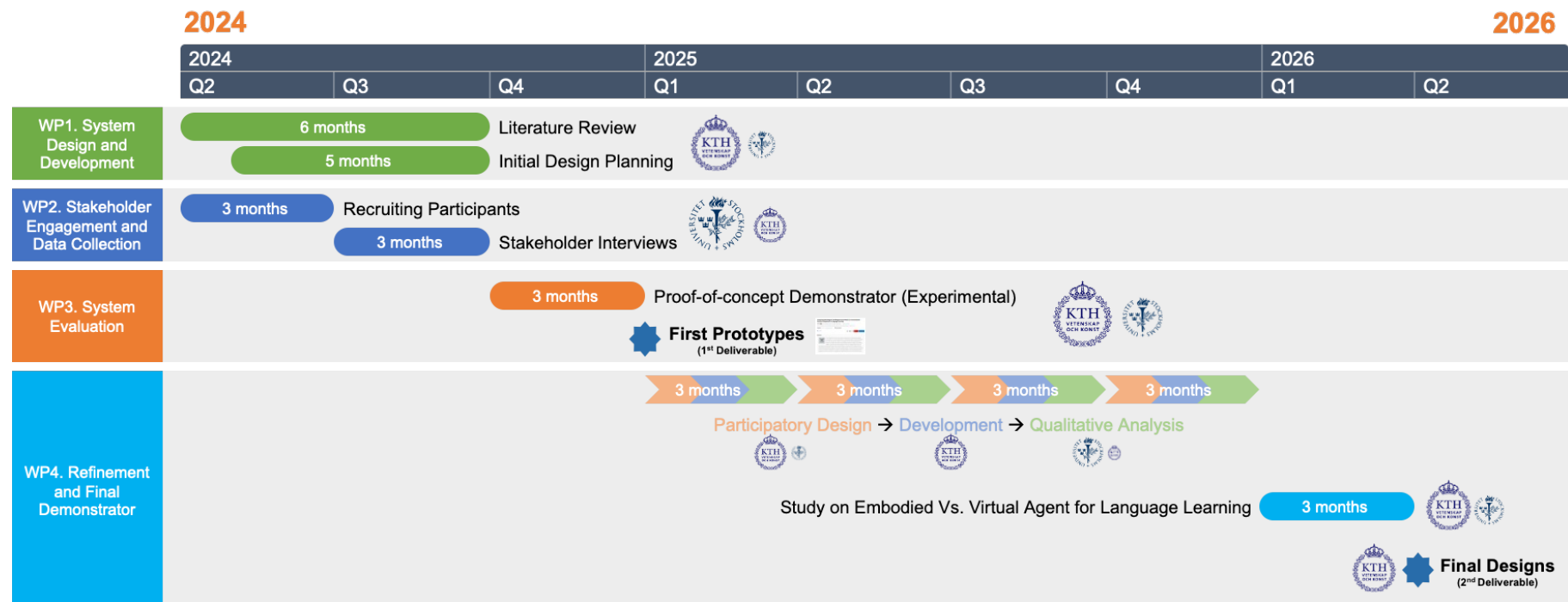


This study explores the impact of monolingual and bilingual robots in Robot-Assisted Language Learning (RALL) for non-native Swedish learners. In a within-group design, 47 participants interacted with a social robot under two conditions: a monolingual robot that communicated exclusively in Swedish and a bilingual robot capable of switching between Swedish and English. Each participant engaged in multiple role-play scenarios designed to match their language proficiency levels, and their experiences were assessed through surveys and behavioral data. The results show that the bilingual robot was generally favored by participants, leading to a more relaxed, enjoyable experience. The perceived learning was improved at the end of the experiment regardless of the condition. These findings suggest that incorporating bilingual support in language-learning robots may enhance user engagement and effectiveness, particularly for lower-proficiency learners.



# Prototype Swedish Conversation Practice through Conversational AI

- A Longitudinal Study
- Collaboration with SFI



# Prototype Swedish Conversation Practice through Conversational AI

- Deployment in Two SFI Schools
- One Year Data Collection
- Study Long Term Effects



# Empowering Cultural Integration and Language Learning through Conversational AI



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**PI: Gabriel Skantze**

*Professor, KTH*



**Co-PI: Ali Reza Majlesi**

*Associate Professor, KI/SU*



A close-up photograph of several fingerprints against a dark blue background. The ridges of the fingerprints are coated with a vibrant, multi-colored marbled paint. The colors include red, yellow, blue, green, and black, swirling together in a complex, organic pattern. The lighting highlights the texture of the paint and the ridges of the skin.

**Thank you**



# Semi-automated math tutoring

Malin Jansson

Assistant professor, Digital learning, KTH

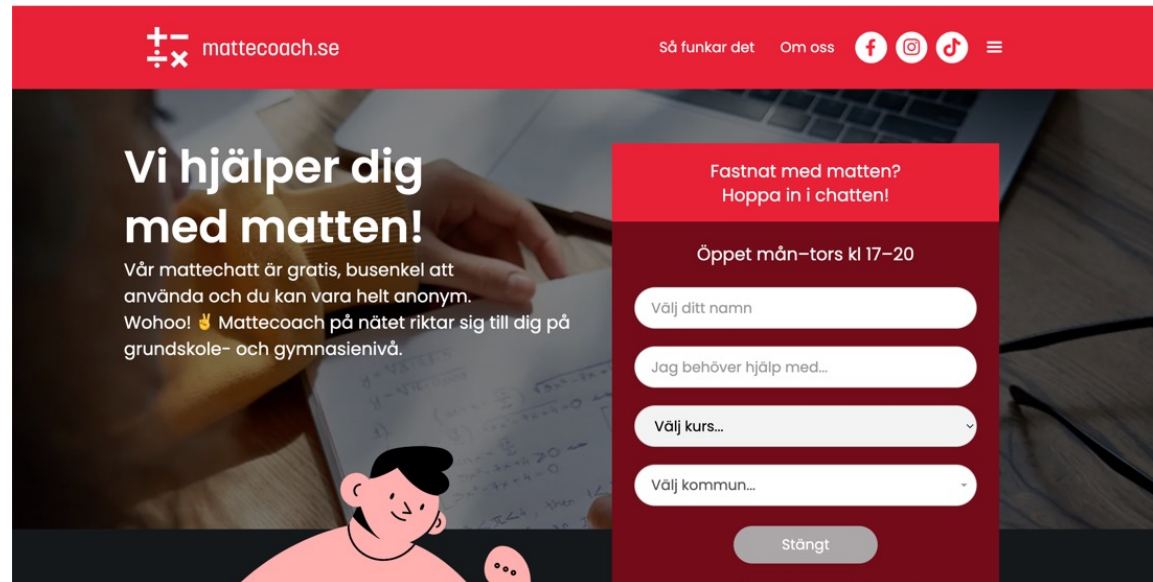
Project team

Stefan Hrastinski, Olof Engwall, Pablo G Oliveras, Kathy Tian



# Math coach online

- Support for students in K-12 math courses
- Open Monday – Thursday 17:00-20:00
- Teacher students as coaches
- Course in online tutoring



The screenshot shows the homepage of mattecoach.se. The header is red with the logo and navigation links. The main content area has a dark background with a hand holding a pen over a notebook. A pink cartoon character is at the bottom left. A red sign-up form is on the right.

mattecoach.se

Så funkarn det Om oss f i d

## Vi hjälper dig med matten!

Vår mattechatt är gratis, busenkel att använda och du kan vara helt anonym. Wohoo! 🙌 Mattecoach på nätet riktar sig till dig på grundskole- och gymnasienivå.

Fastnat med matten?  
Hoppa in i chatten!

Öppet mån-tors kl 17–20

Välj ditt namn

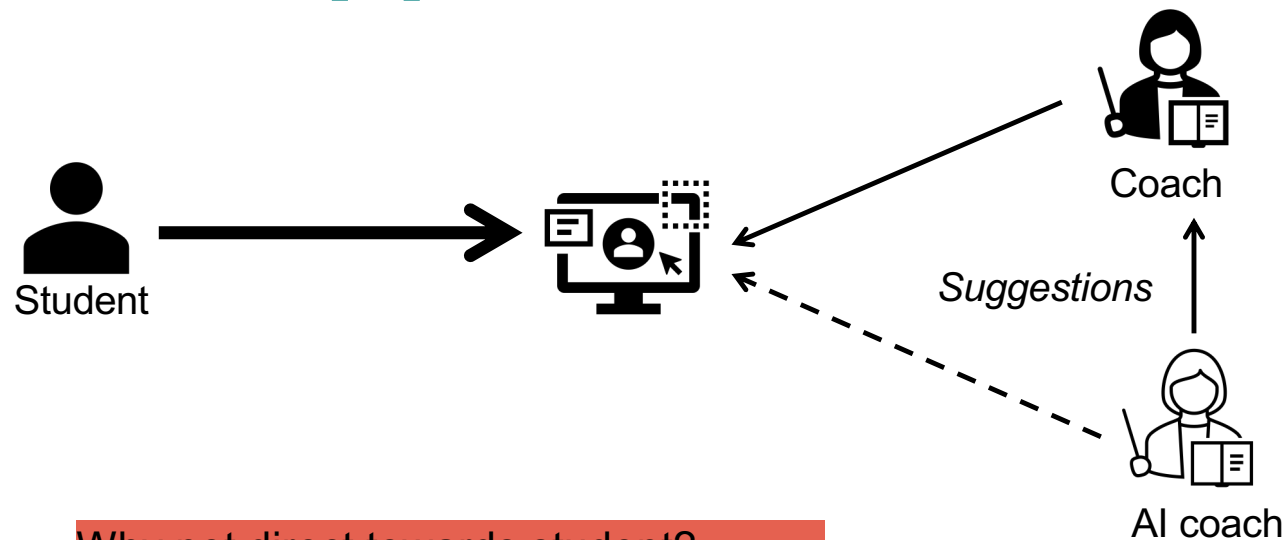
Jag behöver hjälp med...

Välj kurs...

Välj kommun...

Stängt

# AI supported math coach



Samtalsmodellen

| Fas 1<br>Introduktion  | Fas 2<br>Problemlösning  | Fas 3<br>Avslutning   |
|--|--|---|
| Klargöra situationen, sätta ramarna, Identifiera ZPD   | Coacha, handleda <b>elevens</b> lösande, inte lotsa.   | Följa upp, utvärdera, Sammanfatta och generalisera  |
| Vem är eleven?<br>Vad är problemet?<br>Hur har <b>du</b> tänkt?<br>Hur långt har <b>du</b> kommit? | Uppmuntra elevens reflektion och lösningsprocess:<br>Hur kan vi komma fram till vad radien är...?<br>Vad behöver vi för att...?<br>Hur går vi vidare nu? | Vad har vi gjort?<br>Vilka var de viktiga stegen?<br>Hur skulle det blivit om...?<br>Kan du lösa nästa själv? |

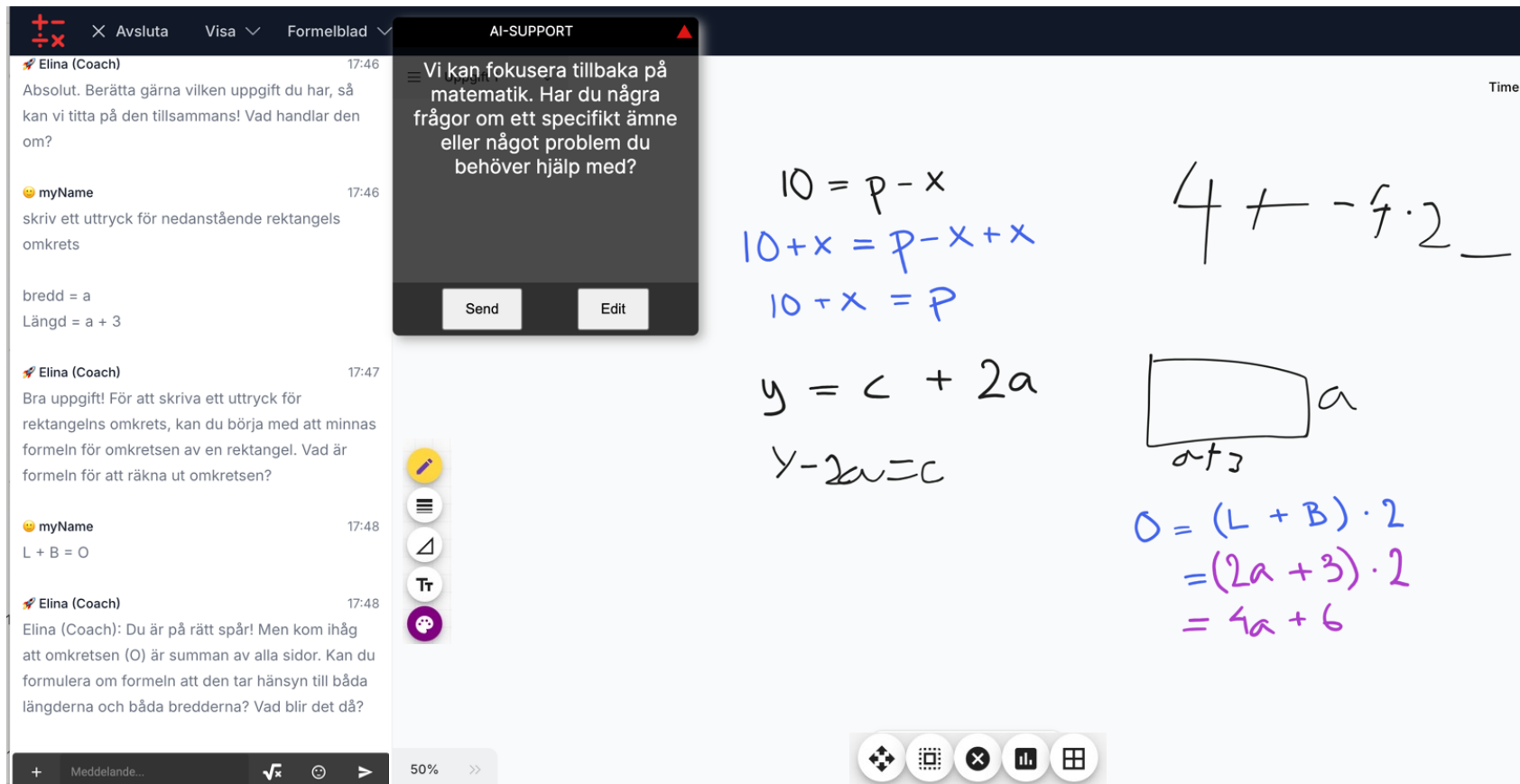
Why not direct towards student?

- GenAI have trouble with math, can make up answers ("hallucinate")
- The human aspect is important
- Other issues may pop up

Why AI support for coaches?

- Several sessions at once
- Keep coaches on the right track

# Semi-automated math tutoring



The screenshot displays the Mattecoach AI-SUPPORT interface. On the left is a chat window with a conversation about a rectangle problem. The main area is a workspace for solving the problem, featuring handwritten equations and a diagram of a rectangle.

**Chat Window:**

- Elina (Coach) 17:46:** Absolut. Berätta gärna vilken uppgift du har, så kan vi titta på den tillsammans! Vad handlar den om?
- myName 17:46:** skriv ett uttryck för nedanstående rektangelns omkrets  
bredd = a  
Längd = a + 3
- Elina (Coach) 17:47:** Bra uppgift! För att skriva ett uttryck för rektangelns omkrets, kan du börja med att minnas formeln för omkretsen av en rektangel. Vad är formeln för att räkna ut omkretsen?
- myName 17:48:**  $L + B = O$
- Elina (Coach) 17:48:** Elina (Coach): Du är på rätt spår! Men kom ihåg att omkretsen (O) är summan av alla sidor. Kan du formulera om formeln att den tar hänsyn till båda längderna och båda bredderna? Vad blir det då?

**AI-SUPPORT Pop-up:**

Vi kan fokusera tillbaka på matematik. Har du några frågor om ett specifikt ämne eller något problem du behöver hjälp med?

**Math Workspace:**

- Equations:
$$10 = p - x$$
$$10 + x = p - x + x$$
$$10 + x = p$$
$$y = c + 2a$$
$$y - 2a = c$$
- Diagram: A rectangle with width labeled  $a$  and length labeled  $a + 3$ .
- Equation:
$$O = (L + B) \cdot 2$$
$$= (2a + 3) \cdot 2$$
$$= 4a + 6$$

A close-up photograph of several fingerprints against a dark blue background. Each fingerprint is covered in a vibrant, multi-colored marbled pattern, resembling liquid paint or ink that has been manipulated to create swirling, wavy lines of red, yellow, green, blue, and black. The patterns are unique to each finger, creating a visually striking and artistic representation of human fingerprints.

**Thank you**

# Transforming Engineering Education with Multimodal GenAI and Intelligent Agents for Improved Students' Problem-Solving Skills

**Olga Viberg & Richard Lee Davis**

Department of Human-Centered Technology (EECS)

Department of Digital Learning (ITM)



# Large Language Models are Transforming Education

I use AI for my studies

83%

Across four Australian universities ([AI in Higher Education: Student Perspectives](#))

ChatGPT

35%

28%

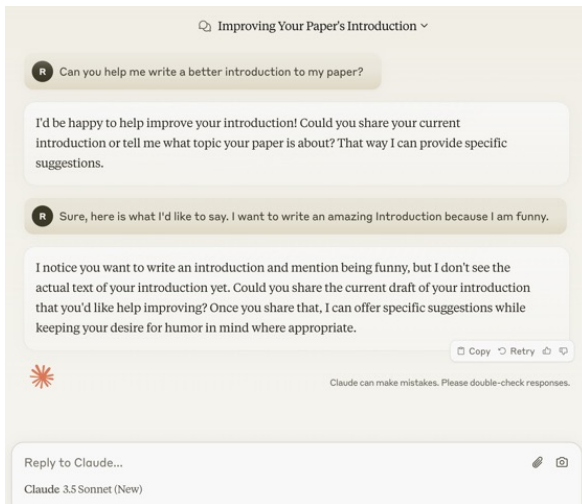
32%

5%

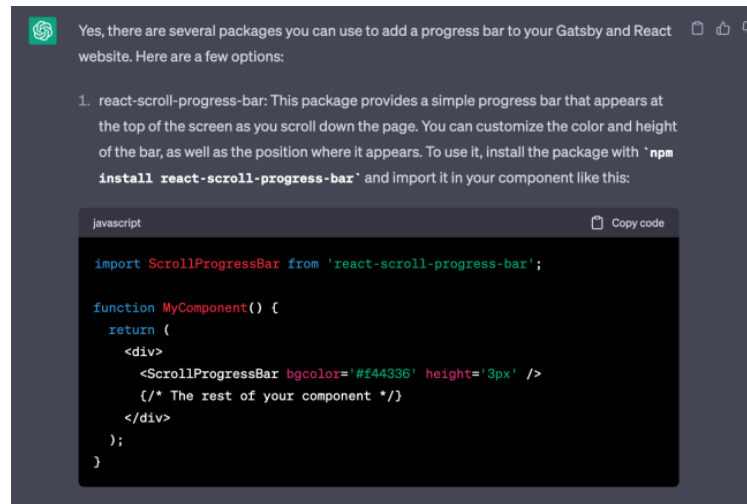
Familiarity and usage of AI chatbots in Swedish universities

([Chatbots and other AI for learning: A survey of use and views among university students in Sweden](#))

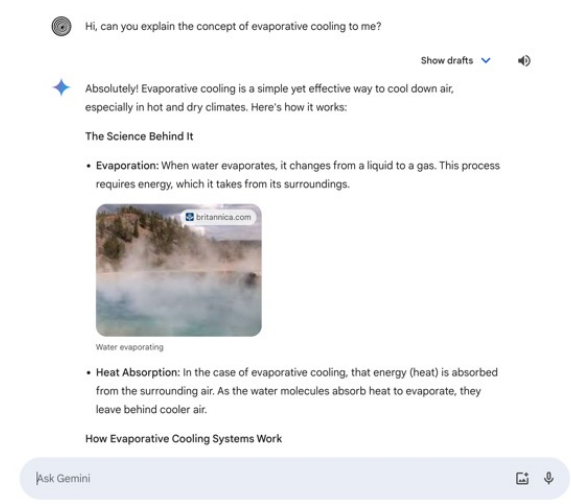




Writing Support



Programming Support



Tutoring and Search

LLMs have been shown to have significant impact on learning when **pedagogically aligned**, but can harm learning when misaligned with learning theories



“We believe in **learning by doing**. That’s why our curriculum largely integrates laboratory sessions, allowing you to gain invaluable practical experience alongside solid theoretical knowledge.” ([Studies at KTH](#))



At MIT, we revel in a culture of **learning by doing**... ([Education | MIT](#))



Stanford students create and apply knowledge by **thinking and doing**... ([Academics | Stanford](#))



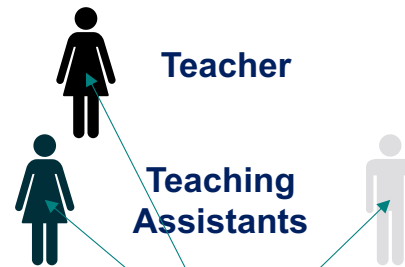
# Many Benefits of Experiential Learning

- **Learning:** Highly effective method to build both applied and theoretical knowledge
- **Skill development:** Complex and ill-defined problem solving, self-regulation, collaboration
- **Engagement and Motivation:** Substantial positive effects
- **Attitudes and Perceptions:** E.g., effective at reducing gender gaps and stereotypes
- **Professional Readiness:** Students are better prepared for professional engineering problems

# But Also Challenges of Experiential Learning

- **Students:** Learning new skills is time-intensive and frustrating (complex and ill-defined problem-solving, self-regulation, collaboration)
- **Teachers:** We know how it should be done (based on the theories of experiential learning and cognitive apprenticeship), but in practice there are obstacles to effective teaching
- **Institutional:** Demonstrating impact, evaluation, funding

# $\mu$ TA: Pedagogically Aligned L $\mu$ M Agent for Experiential Learning



Student Groups



# Project Goals

- ✓ Pioneer the use of Large Multimodal Models (L $\mu$ Ms) in new learning environments and to support new skills and learning outcomes
- ✓ Identify and Develop novel methods for aligning L $\mu$ M agents with desired pedagogical behaviors
- ✓ Collect and analyze multimodal data to power real-time feedback systems for teachers
- ✓ Empirically evaluate the impact of pedagogically aligned L $\mu$ M agents on student and teacher outcomes in experiential learning courses





Prototype shown



A close-up photograph of several fingerprints against a dark blue background. The ridges of the fingerprints are coated with a vibrant, multi-colored marbled paint. The colors include red, yellow, blue, green, and black, swirling together in a fluid, organic pattern. The lighting highlights the texture of the paint and the ridges of the skin.

**Thank you**

# digital futures

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PARTNERS

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