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

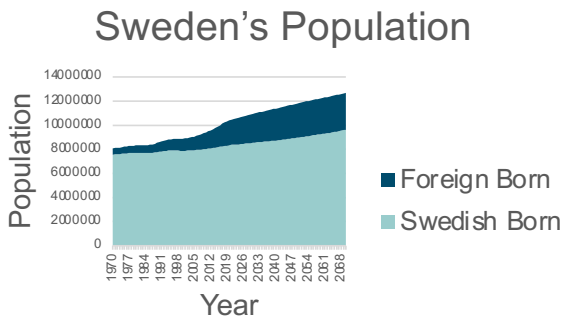
Co-PI: Ali Reza Majlesi

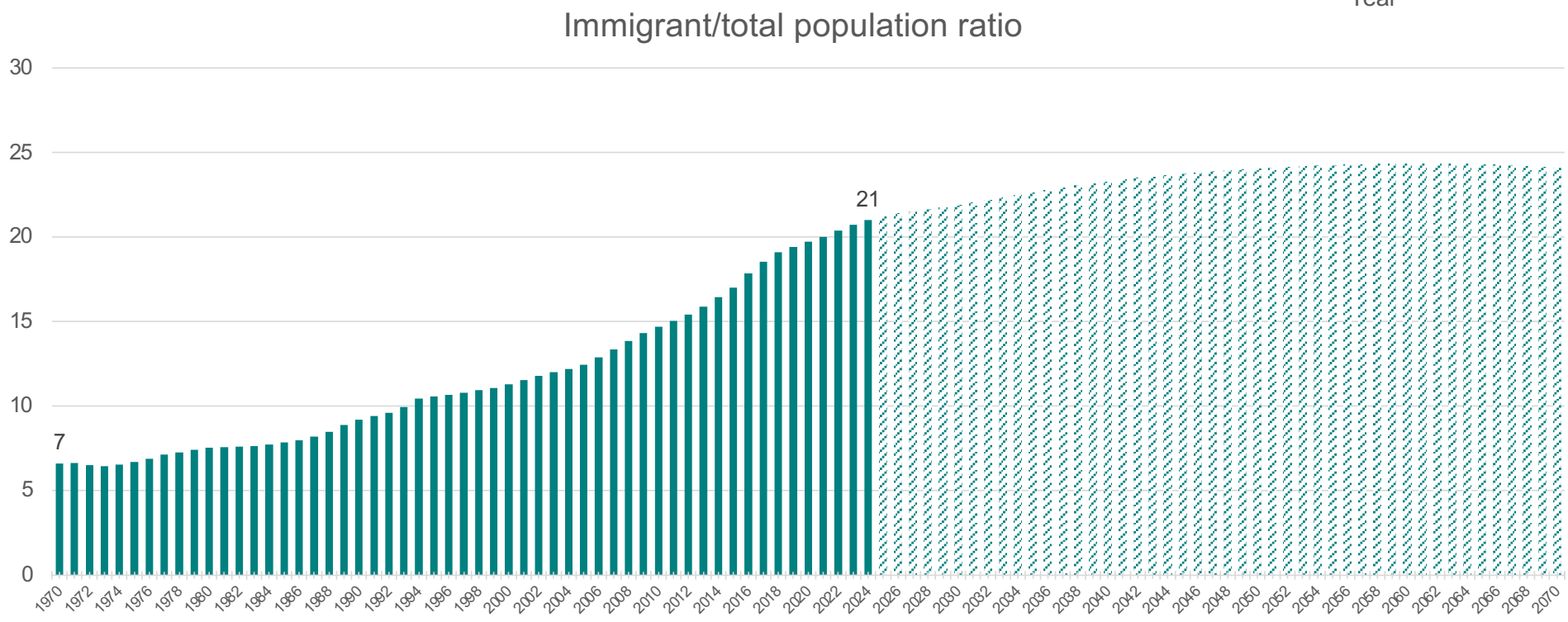
Associate Professor, SU

Sociocultural and interactional perspectives on social interactions

Second language acquisition, classroom interactions and teaching and learning processes

Problem


Sweden's Population
Population
Year
Foreign Born
Swedish Born


Immigrant/total population ratio
7
21

Project's Vision
A New Approach to Language Learning

Innovative use of social robots & virtual agents

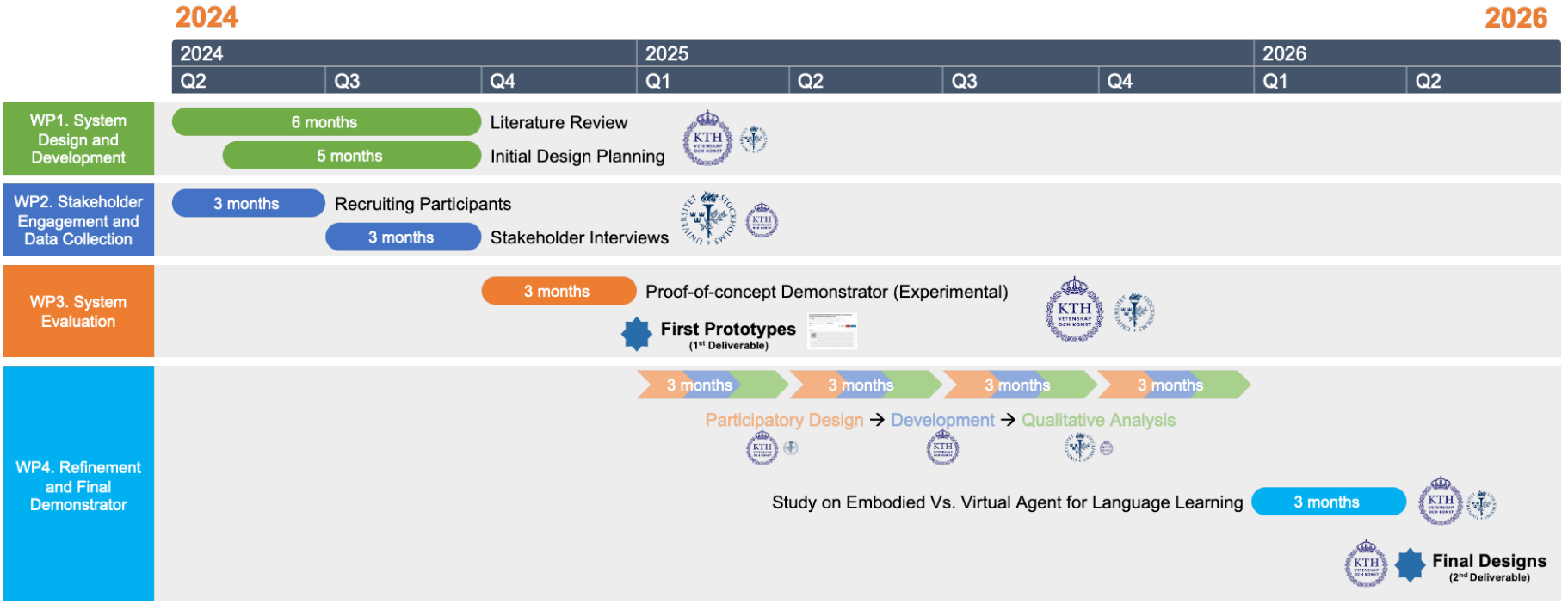
User-centered design with participatory approach

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

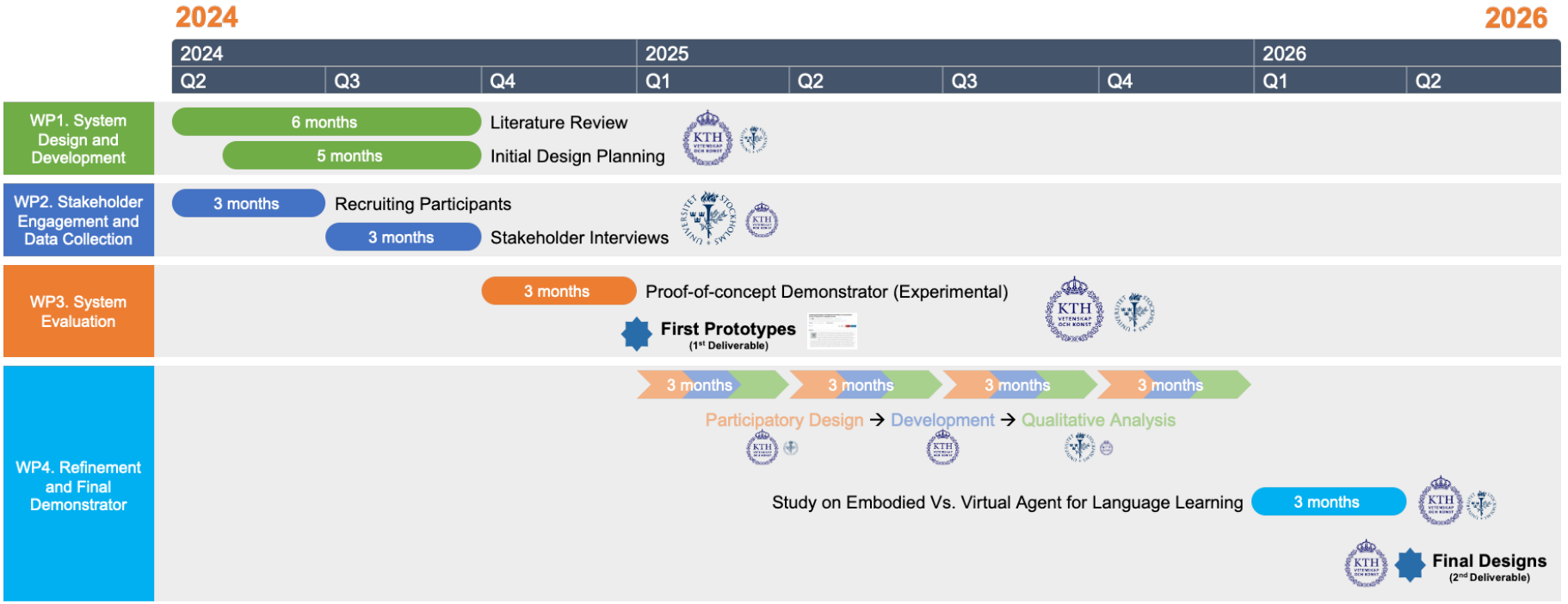
Check for updates

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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Associate Professor, KI/SU

KTH VETENSKAP OCH KONST

UNIVERSITET STOCKHOLMS

Thank you

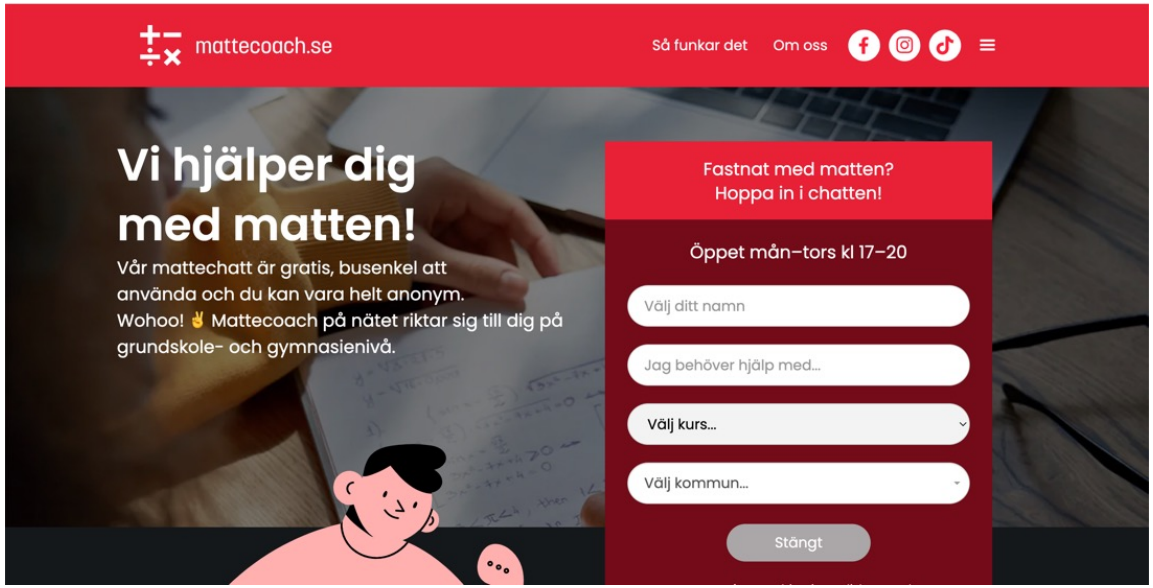
Semi-automated math tutoring

Malin Jansson
Assistant professor, Digital learning, KTH

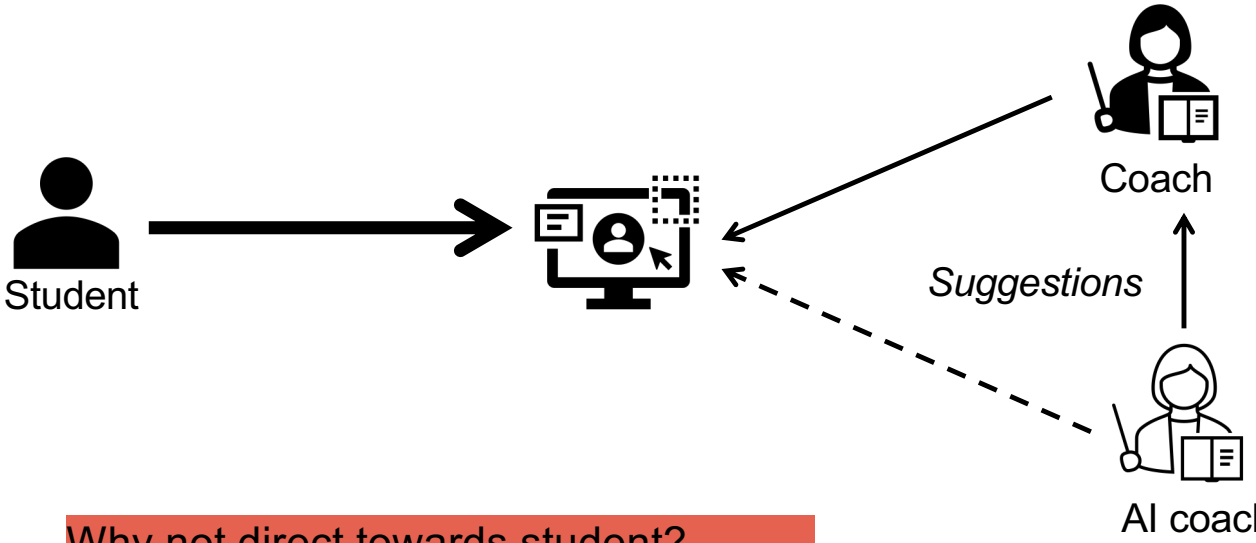
Project team
Stefan Hrastinski, Olof Engwall, Pablo G Oliveras, Kathy Tian

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



AI supported math coach



Samtalsmodellen

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

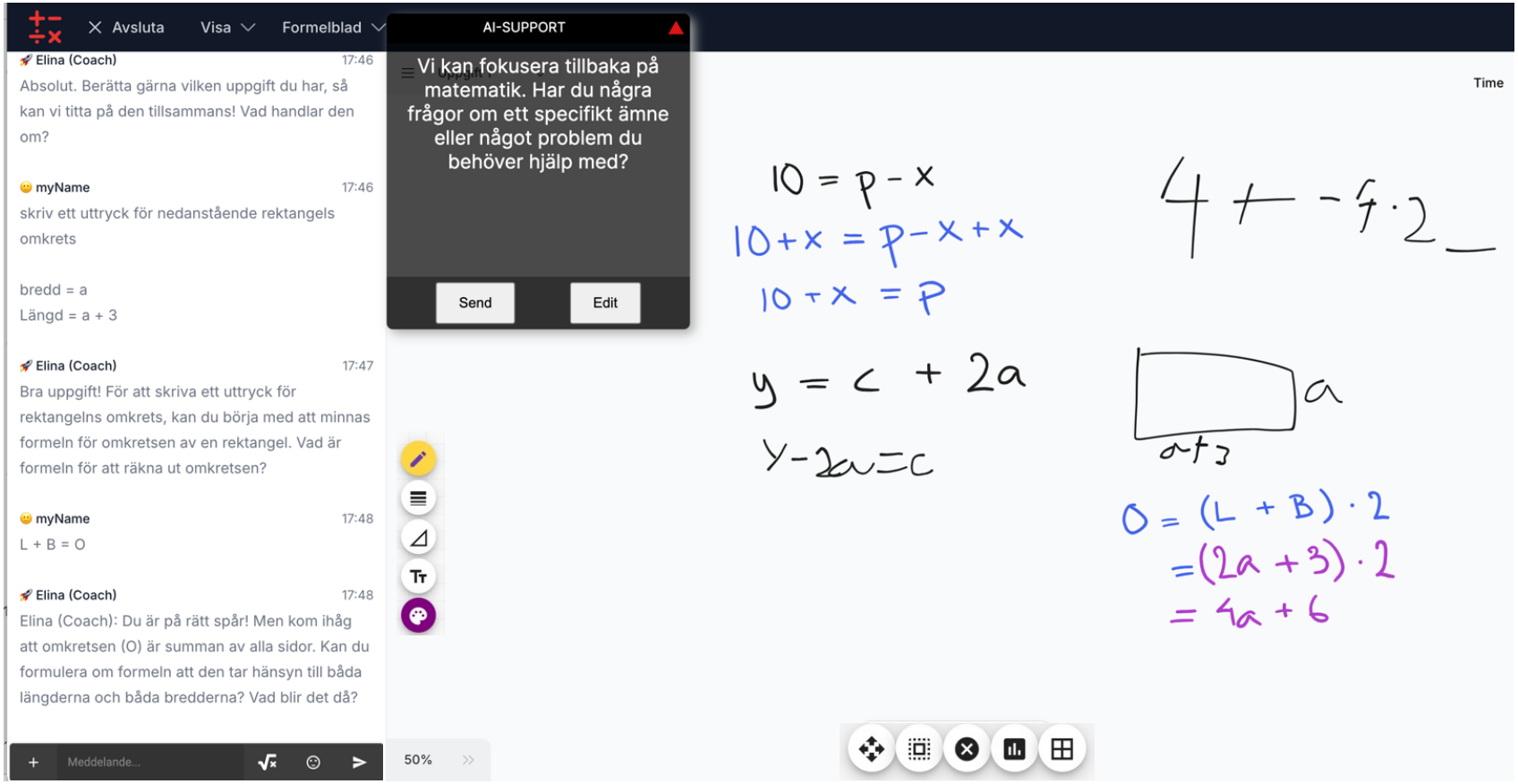
Why not direct towards student?

- 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



Thank you

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

Olga Viberg & Richard Lee Davis

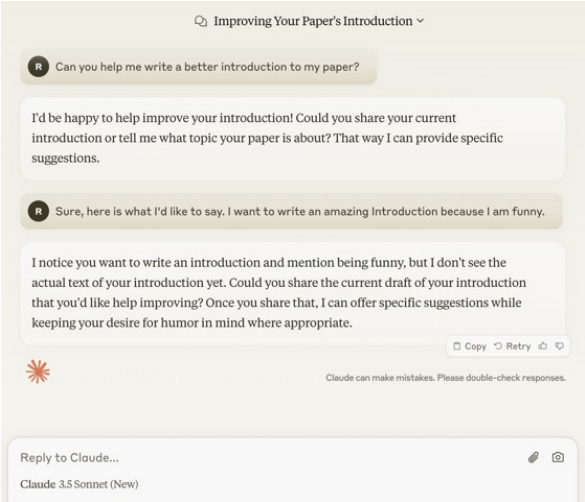
Department of Human-Centered Technology (EECS)

Department of Digital Learning (ITM)

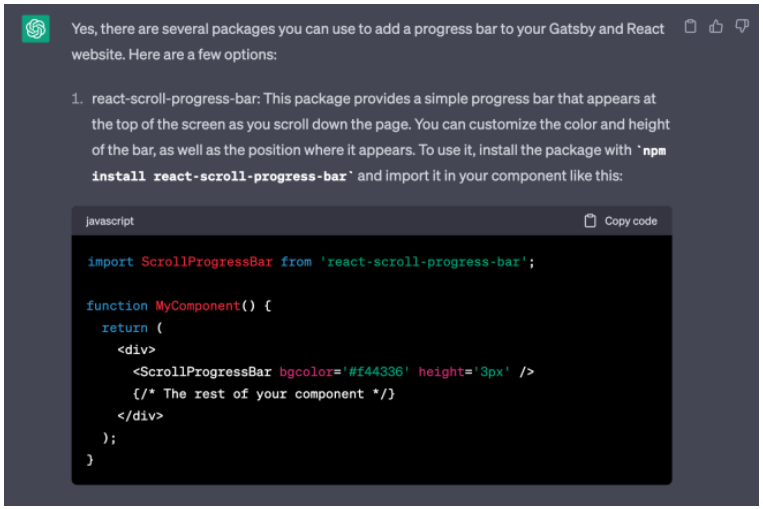
Large Language Models are Transforming Education

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

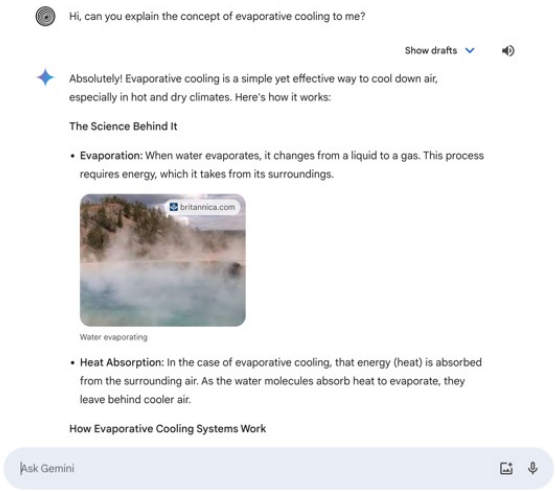
Familiarity and usage of AI chatbots in Swedish universities
(Chatbots and other AI for learning: A survey of use and views among university students in Sweden)



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)

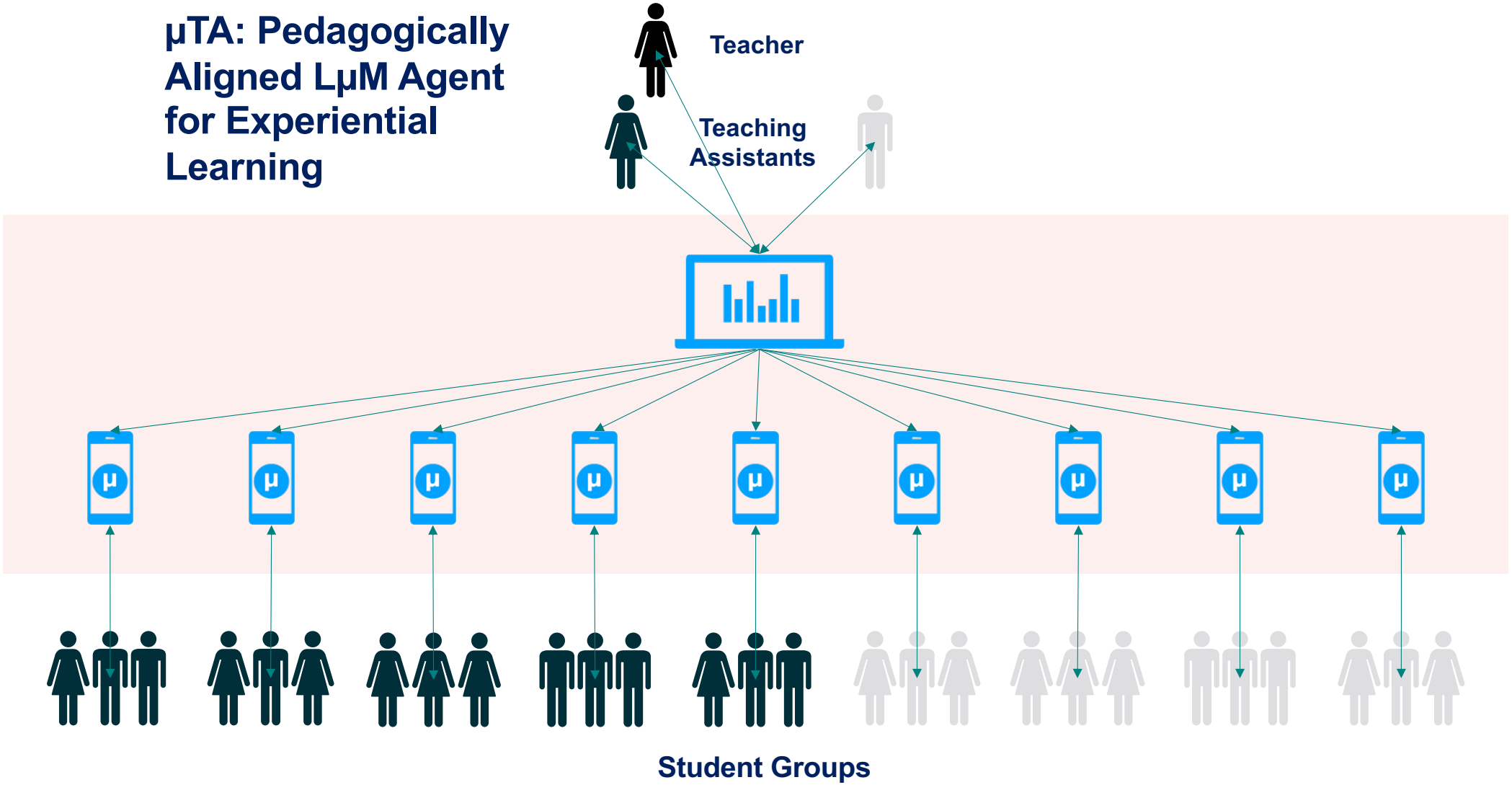
Many Benefits of Experiential Learning

- **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

µTA: Pedagogically Aligned LµM Agent for Experiential Learning



Project Goals

- ✓ Pioneer the use of Large Multimodal Models (LμMs) in new learning environments and to support new skills and learning outcomes
- ✓ Identify and Develop novel methods for aligning LμM 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 LμM agents on student and teacher outcomes in experiential learning courses


Prototype shown

Thank you

digital futures

PARTNERS