Complementing Human Minds with Digital Brains: Intelligence Augmentation (IA)

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HARVARD GRADUATE SCHOOL OF EDUCATION

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  Applied Learning Science for Access, Innovation, and Mastery

with thanks to Ashley Etemadi, researcher at the Next Level Lab

WHY ARE LLM AN IMPORTANT OPPORTUNITY FOR TEACHING, LEARNING, AND ASSESSMENT?

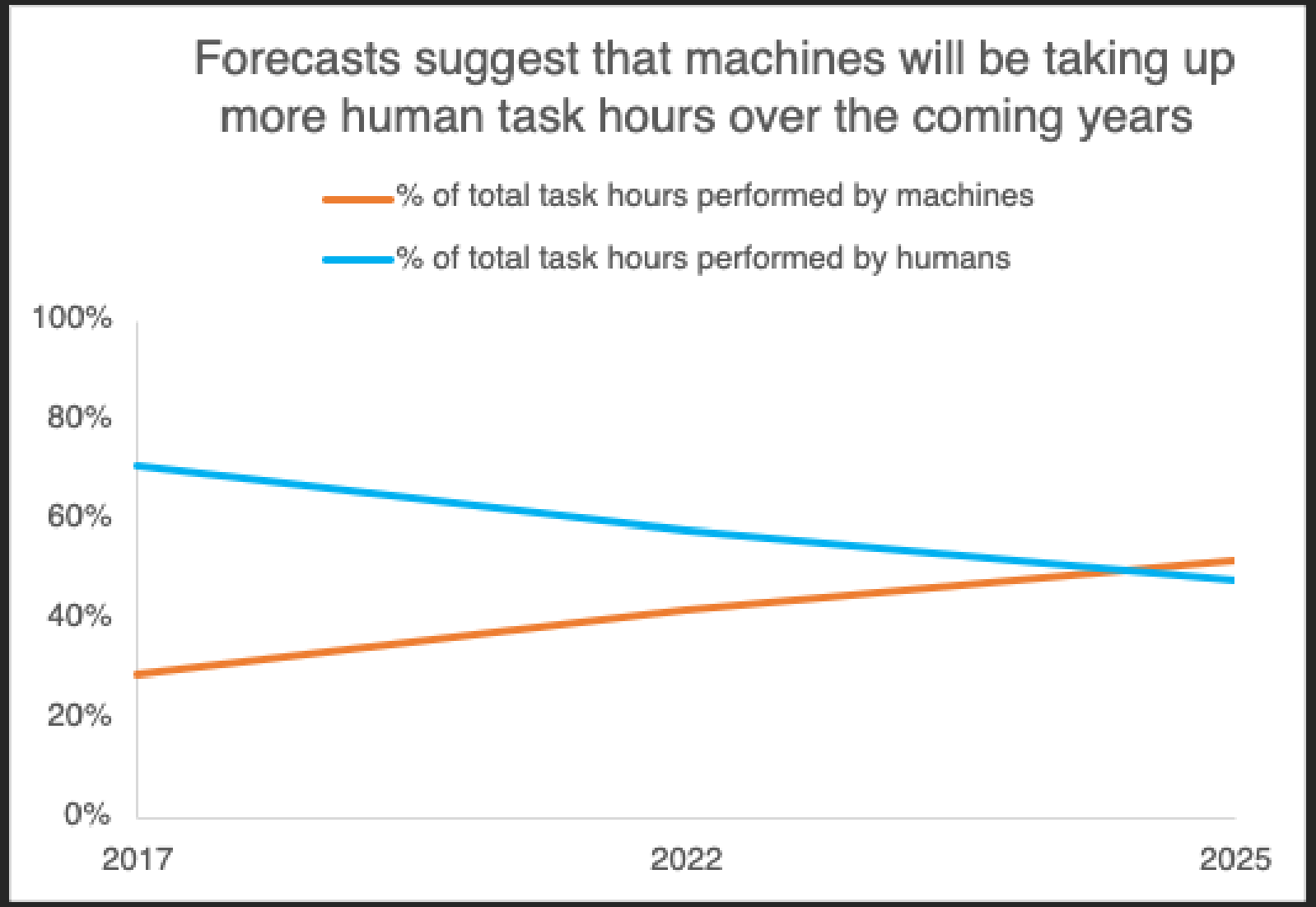
LLM solve the natural language processing problem (NLP)

- Paraphrase
- Idioms
- Implicit and tacit understandings
- Multiple languages

Fluent verbal and textual interaction

INTELLIGENCE AUGMENTATION

- Advances in machine learning are changing the division of labor
- "Intelligence" involves complementary roles of "judgment" and "reckoning"
- Hybrid machine and human teams will have machines providing reckoning, freeing people to focus more on judgment and decision making
- This complementarity between humans and AI leads to "intelligence augmentation," **but only if people upskill**

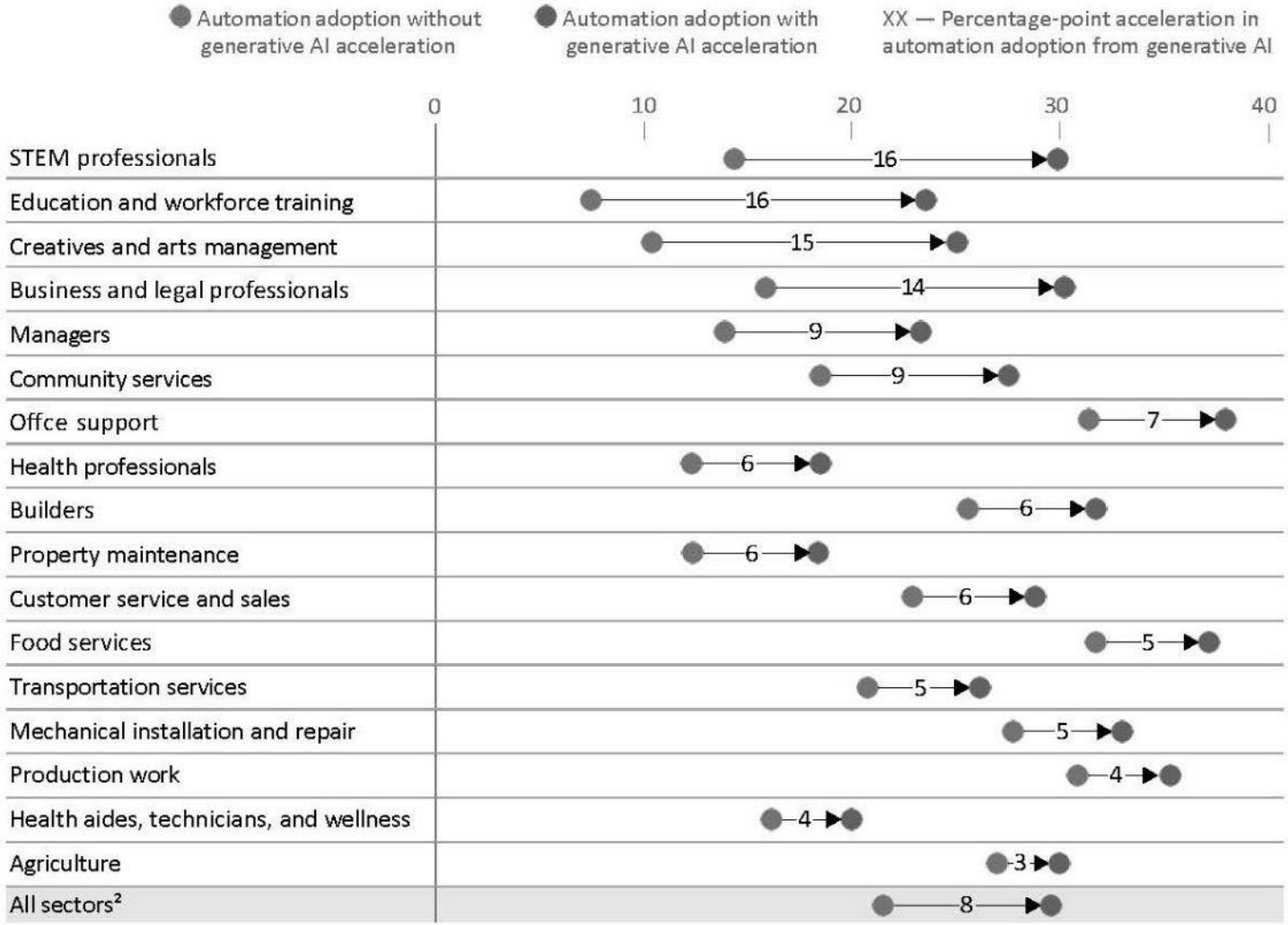

Forecasts suggest that machines will be taking up more human task hours over the coming years
% of total task hours performed by machines
% of total task hours performed by humans
100%
80%
60%
40%
20%
0%
2017
2022
2025

Cann, 2018

Exhibit 8

With generative AI added to the picture, 30 percent of hours worked today could be automated by 2030.

Midpoint automation adoption[1] by 2030 as a share of time spent on work activities, US, %



[1]Midpoint automation adoption is the average of early and late automation adoption scenarios as referenced in *The economic potential of generative AI: The next productivity frontier*, McKinsey & Company, June 2023.
[2]Totals are weighted by 2022 employment in each occupation.
Source: O*NET; US Bureau of Labor Statistics; McKinsey Global Institute analysis

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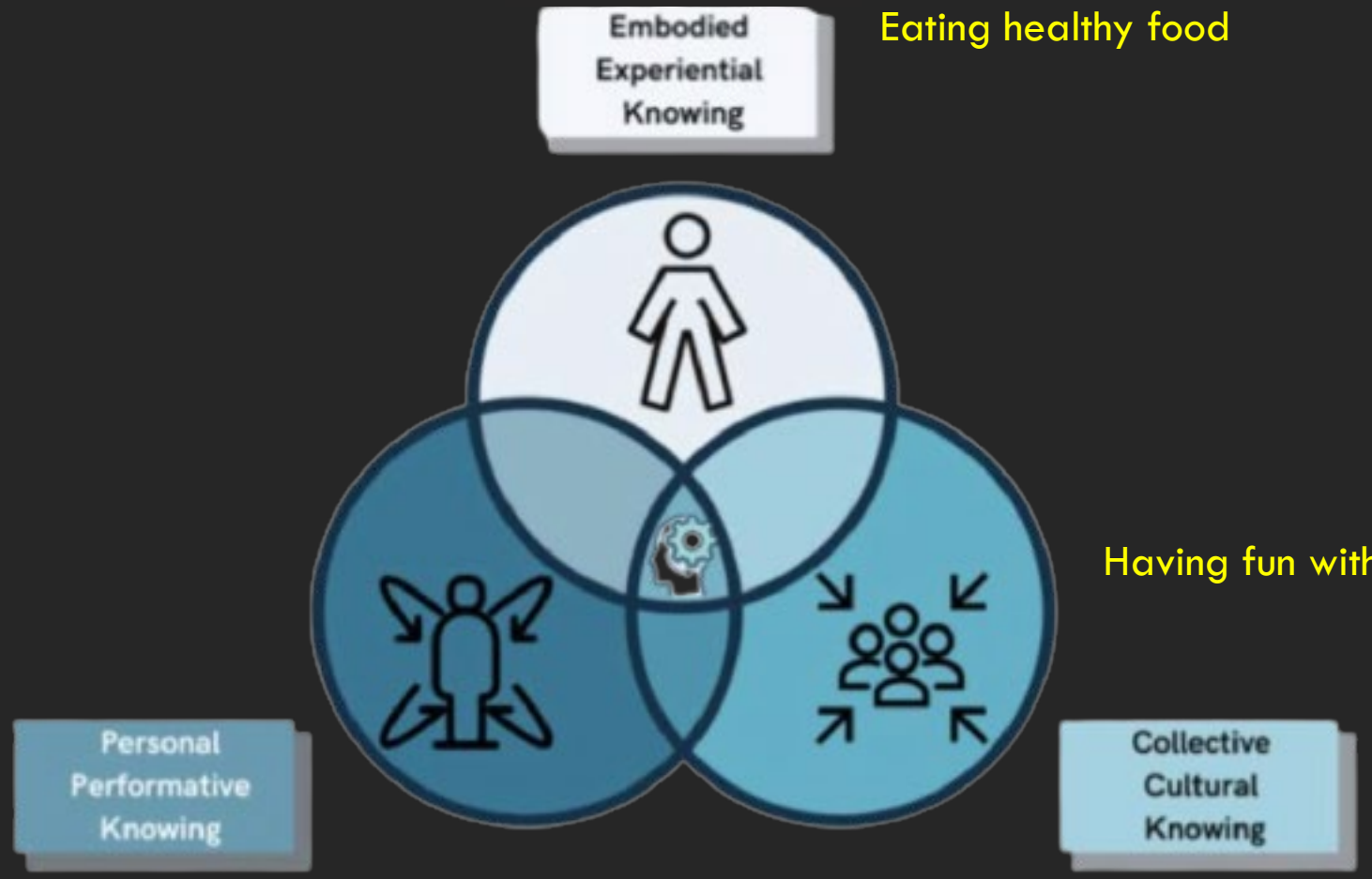
Captain Picard
Data

RECKONING VERSUS JUDGMENT

Reckoning is calculative prediction	Judgment is practical wisdom
Programs that can estimate the life expectancy of a particular cancer patient, given their characteristics, the specific disease, and available treatments	Healthcare workers counseling cancer patients can help them choose treatment options, factoring in quality of life versus life expectancy, tolerance for pain, personal and cultural beliefs about death, family circumstances, spiritual beliefs

SENDING KIDS THE RIGHT MESSAGE ABOUT AI



Eating healthy food

Crossing a busy street

Having fun with friends at the playground

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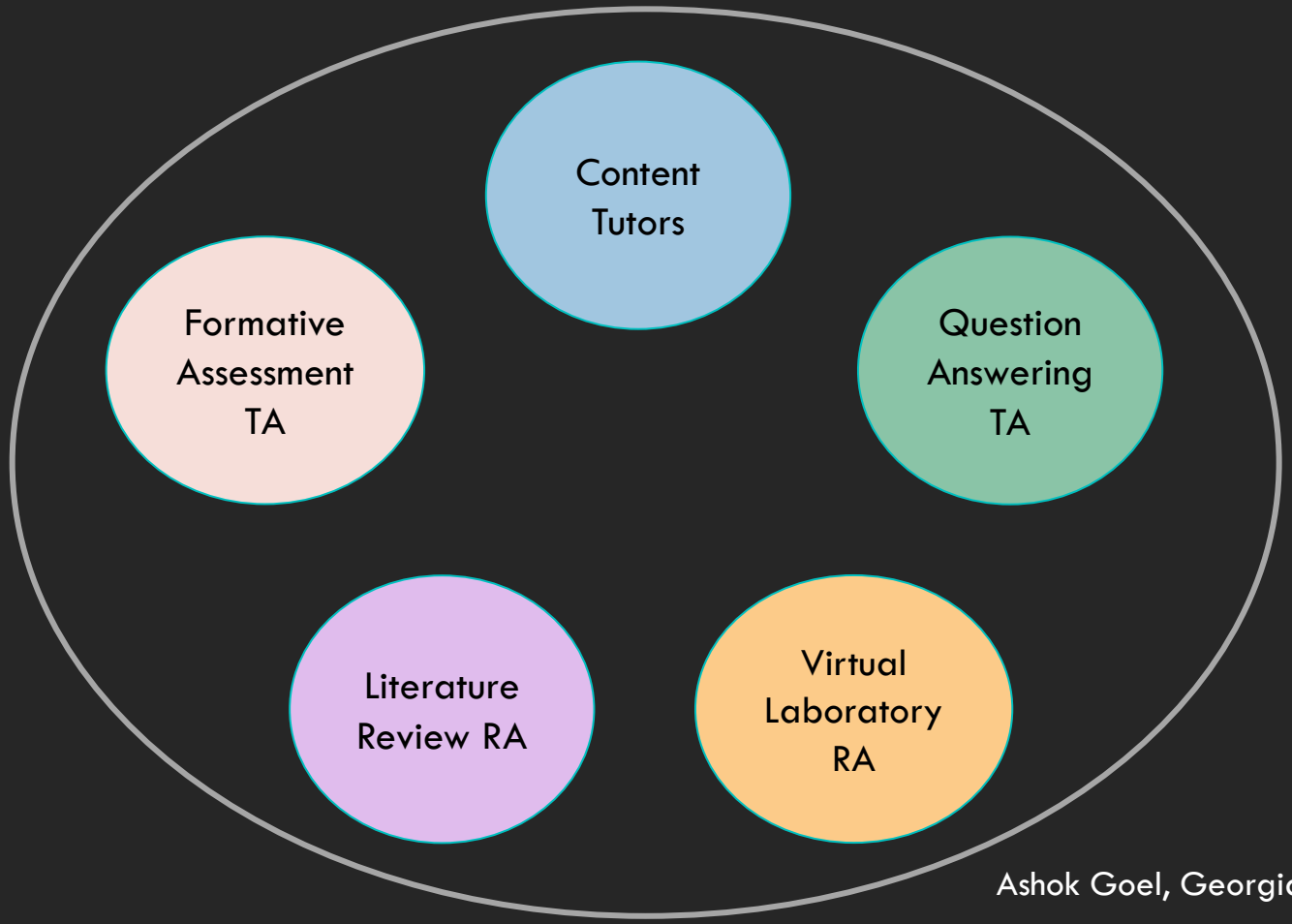
A COORDINATED SUITE OF AI TECHNOLOGIES

(based on functional roles of human teachers)



Ashok Goel, Georgia Tech

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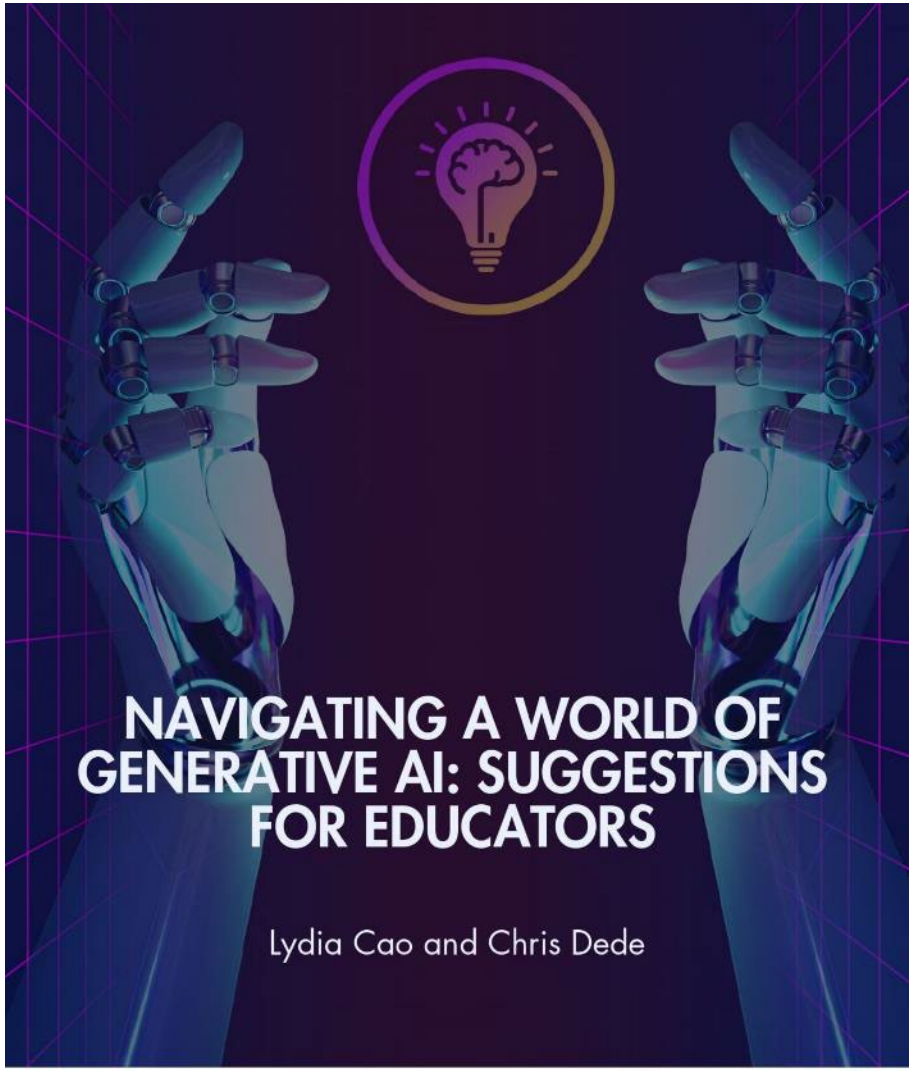
ML Does Well on High-Stakes Tests, including *Descriptive* Writing and Art

Intelligence Augmentation: Upskilling Humans to Complement AI

Applying Learning Sciences Research to Learning and Workforce Development for Next Level Learning Brief Series

Chris Dede, Ashley Etemadi, and Tessa Forshaw



HARVARD GRADUATE SCHOOL OF EDUCATION

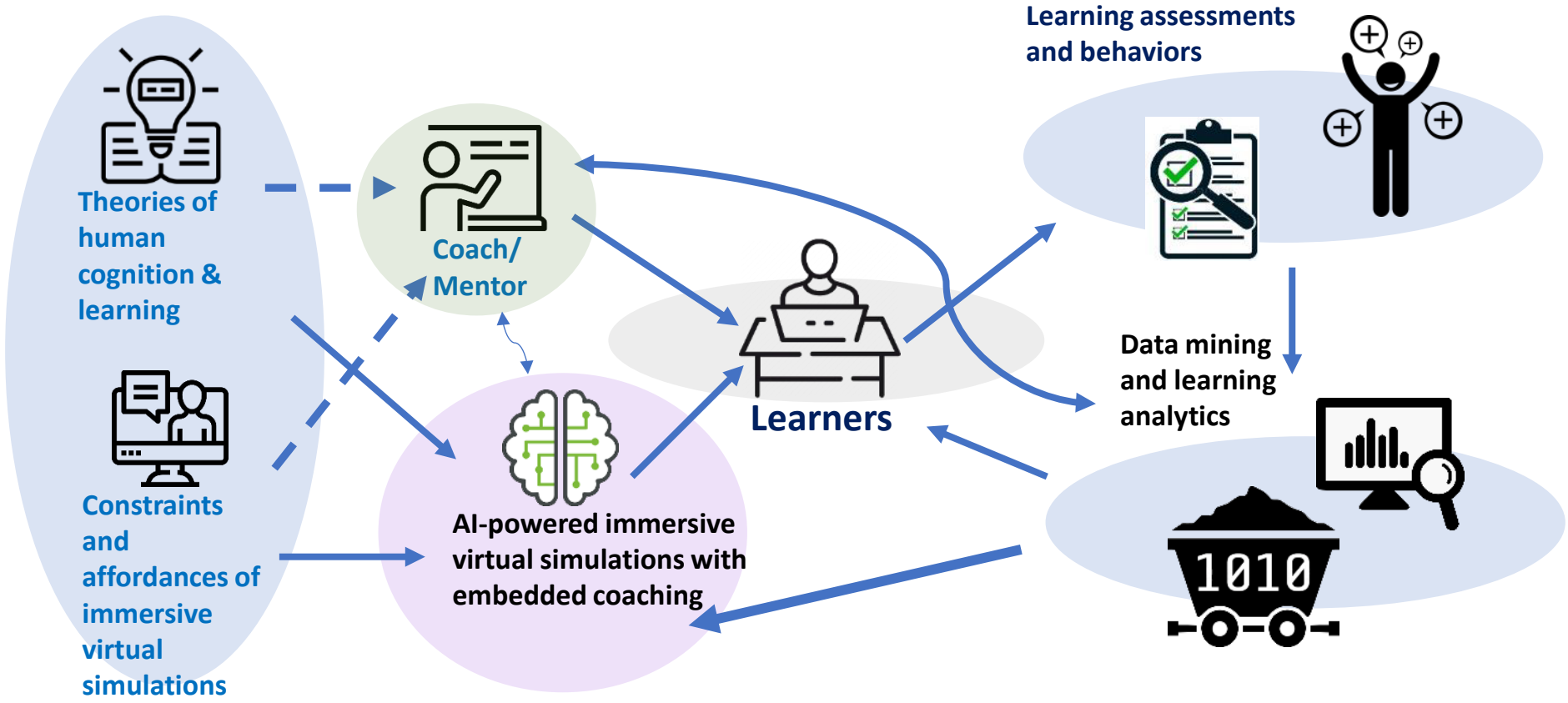
NEXT LEVEL LAB

IN LEARNING, THE DESTINATION IS *THE JOURNEY*

Your written essay is not the goal, but a means to learning the skill of expressing your original thoughts in words.

National AI Institute: Adult Learning and Online Education

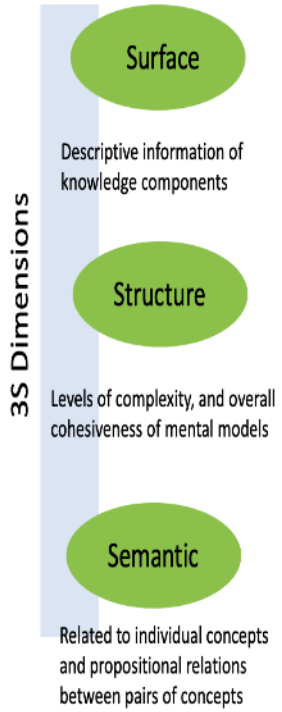
Feedback loops among Coaches, Learners, and AI Performance Simulators



https://aialoe.org/

SMART for Enhancing Concept Learning

- Deployed in 17 English and Biology classes with 350 learners at TCSG.
- *Learners demonstrated a significant improvement in their knowledge structure*.
- SMART-supported concept learning significantly influenced learners' positive perceptions of AI technology and their classroom performance.



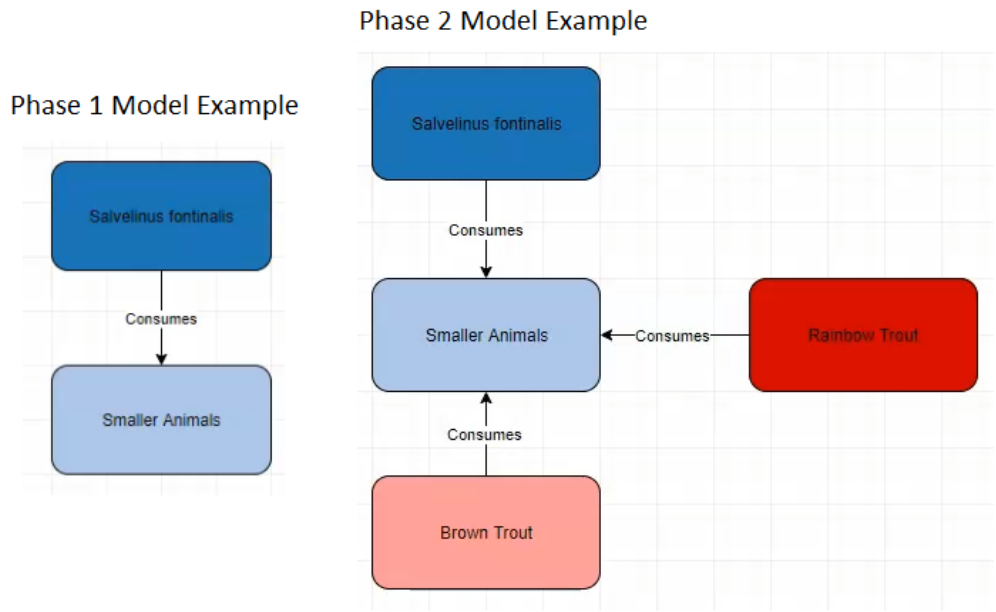
Similarity Change Heat Map (Final Model – Initial Model)

		English			Biology
		Summer	Fall	Total	Fall
Surface	S-Number of Concepts	11.84	32.12	45.280	
	S-Number of Relations	20.36	54.14	81.54	12.41
	S-Density	6.3	17.38	25.94	
Structure	S-Average Degree		7.86	14.36	14.33
	S-Mean Distance		14.68	19.98	
	S-Diameter		6.58	10.59	
Semantic	Concept Matching	16.56	95.3	112.54	29.39
	Propositional Matching		8.37	14.44	19.61
	Recall-C	57.38	208.64	285.55	68.8
	Recall-P	68.26	228.16	326.92	92.66

Note. Significant *F* values are included in the cells.

VERA for Enhancing Model Learning

- Deployed VERA in classes on natural resource management at North Georgia Technical College.
- Instructors of these courses *unexpectedly* used VERA as an assessment tool on the final exam.
- *88% of students had model complexities higher than the 6 required on the exam, with the average being around 15.*



https://www.wondavr.com/case-studies/ai-mystery

USING DIGITAL PUPPETEERING TO TEACH NEGOTIATION

Experienced teachers of negotiation were impressed by the authenticity of the Mursion experience and the degree to which immersion created a suspension of disbelief and an atmosphere of high stakes outcomes.

Artificial Intelligence and Technology in Teaching Negotiation

Samuel "Mooly" Dinnar, Chris Dede, Emmanuel Johnson, Carrie Straub, and Kristjan Korjus*

Artificial intelligence (AI), machine learning (ML), affective computing, and big-data techniques are improving the ways that humans negotiate and learn to negotiate. These technologies, long deployed in industry and academic research, are now being adopted for educational use. We describe several systems that help human negotiators evaluate and learn from role-play simulations as well as applications that help human instructors teach negotiators at the individual, team, and organizational levels. AI can enable the personalization of negotiation instruction, taking into consideration factors such as culture and bias. These tools will enable improvements not only in the teaching of negotiation, but also in teaching humans how to program and collaborate with technology-based negotiation

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Chris Dede is the Timothy E. Wirth Professor in Learning Technologies at Harvard's Graduate School of Education and an advisor to Mursion, Inc. His fields of scholarship include emerging technologies, policy, and leadership. His e-mail address is chris_dede@gse.harvard.edu.

Emmanuel Johnson is a PhD student in computer science at the University of Southern California and is advised by Jonathan Gratch. His research explores the benefits of AI simulations that provide personalized feedback for negotiation training. His e-mail address is cjohnson@ict.usc.edu.

Carrie Straub is the Executive Director of Education Programs and Research for Mursion, Inc. Previously, she was the research director for TeachLivE, the project at the University of Central Florida that originally developed and tested the core technology utilized by Mursion. Her e-mail address is carrie.straub@mursion.com.

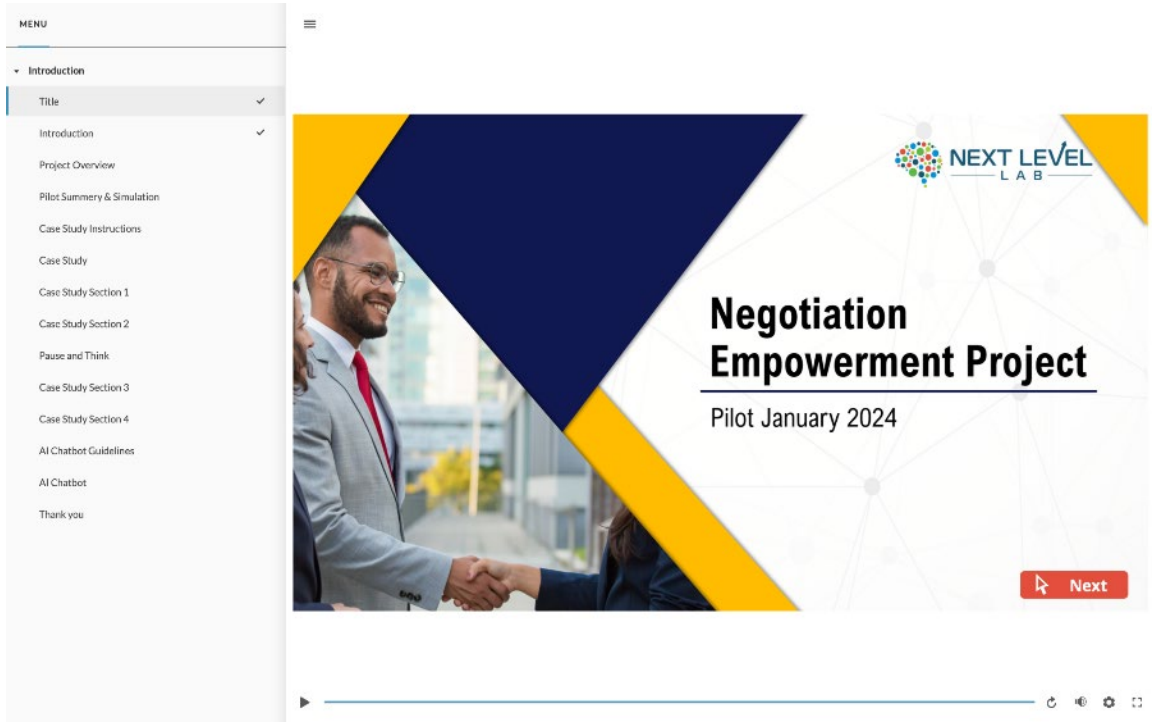
Kristjan Korjus is a cofounder and CTO of Pactum AI, Inc. He holds a Ph.D. in computer science from the University of Tartu and a First Class Honours masters degree in mathematics from the University of Manchester. His e-mail address is kristjan@pactum.com.

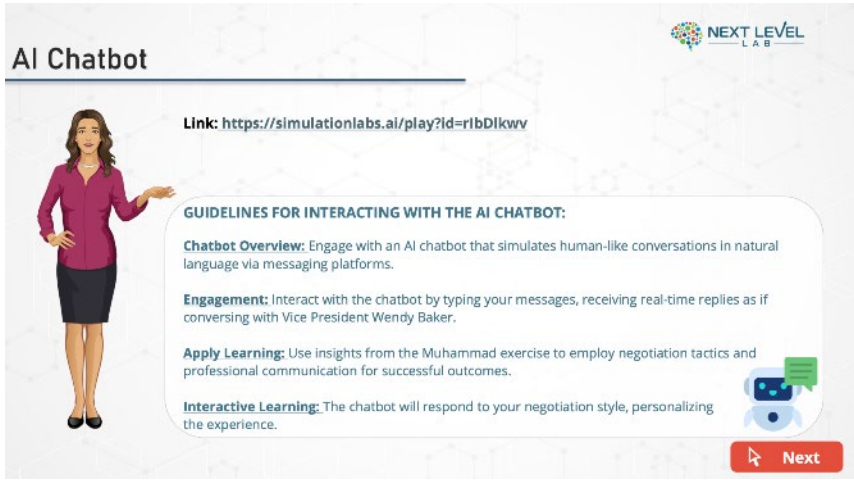
10.1111/nejo.12351

NEGOTIATION AT DIFFERENT LEVELS OF AUTHENTICITY

Need digital puppeteering for sophisticated learning, but initial learning can use various types of chatbots (movies: lead actors, character actors, extras)

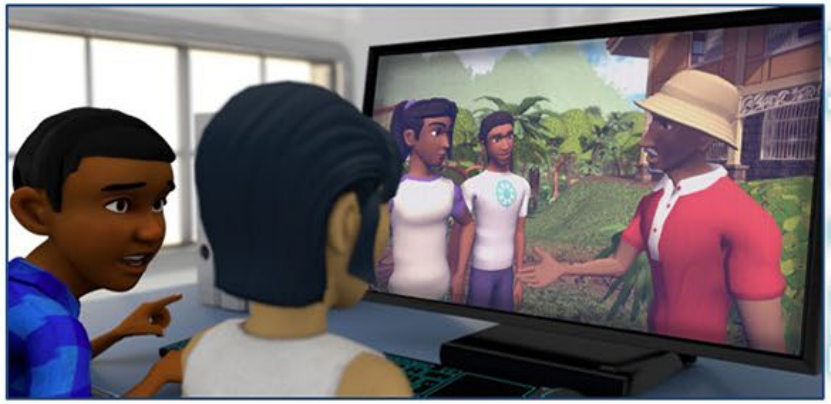
Negotiation Empowerment Project





https://www.colorado.edu/research/ai-institute/

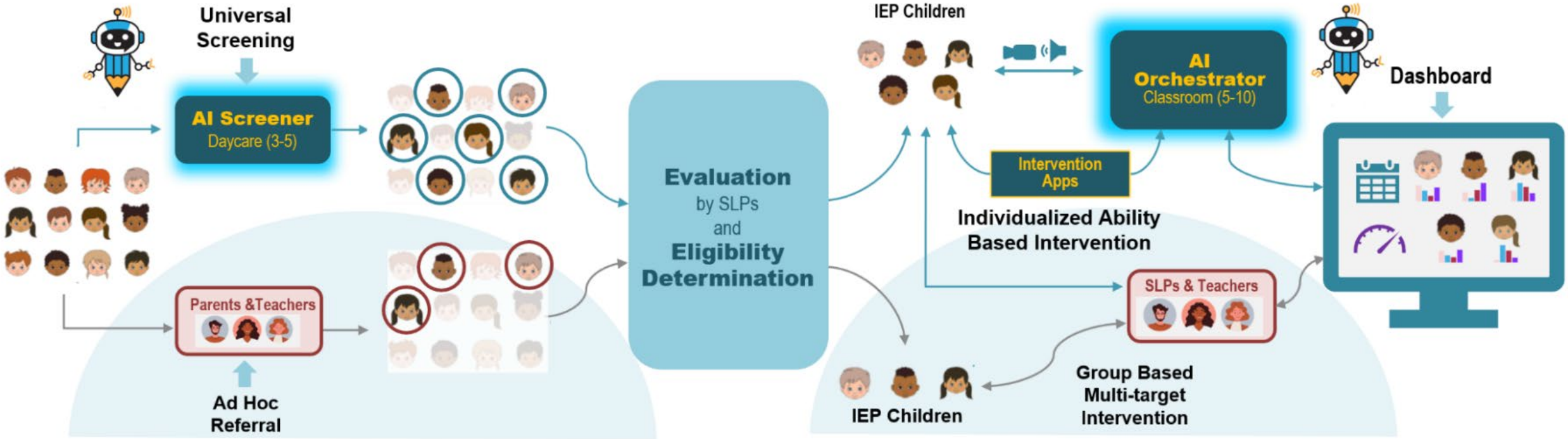
https://sites.google.com/ncsu.edu/ai-engage/home



Story-Based
Collaborative
Inquiry Learning

Narrative-Centered Learning

https://www.buffalo.edu/ai4exceptionaled.html

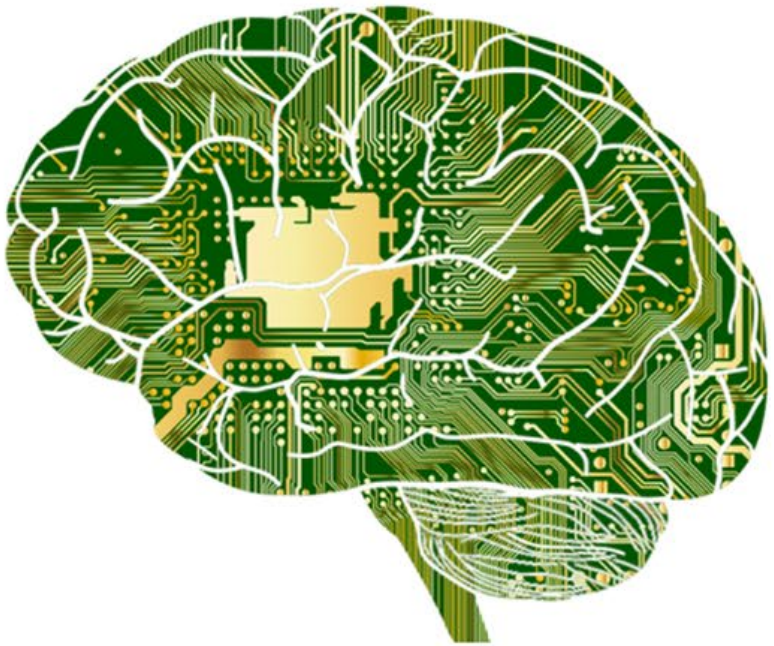


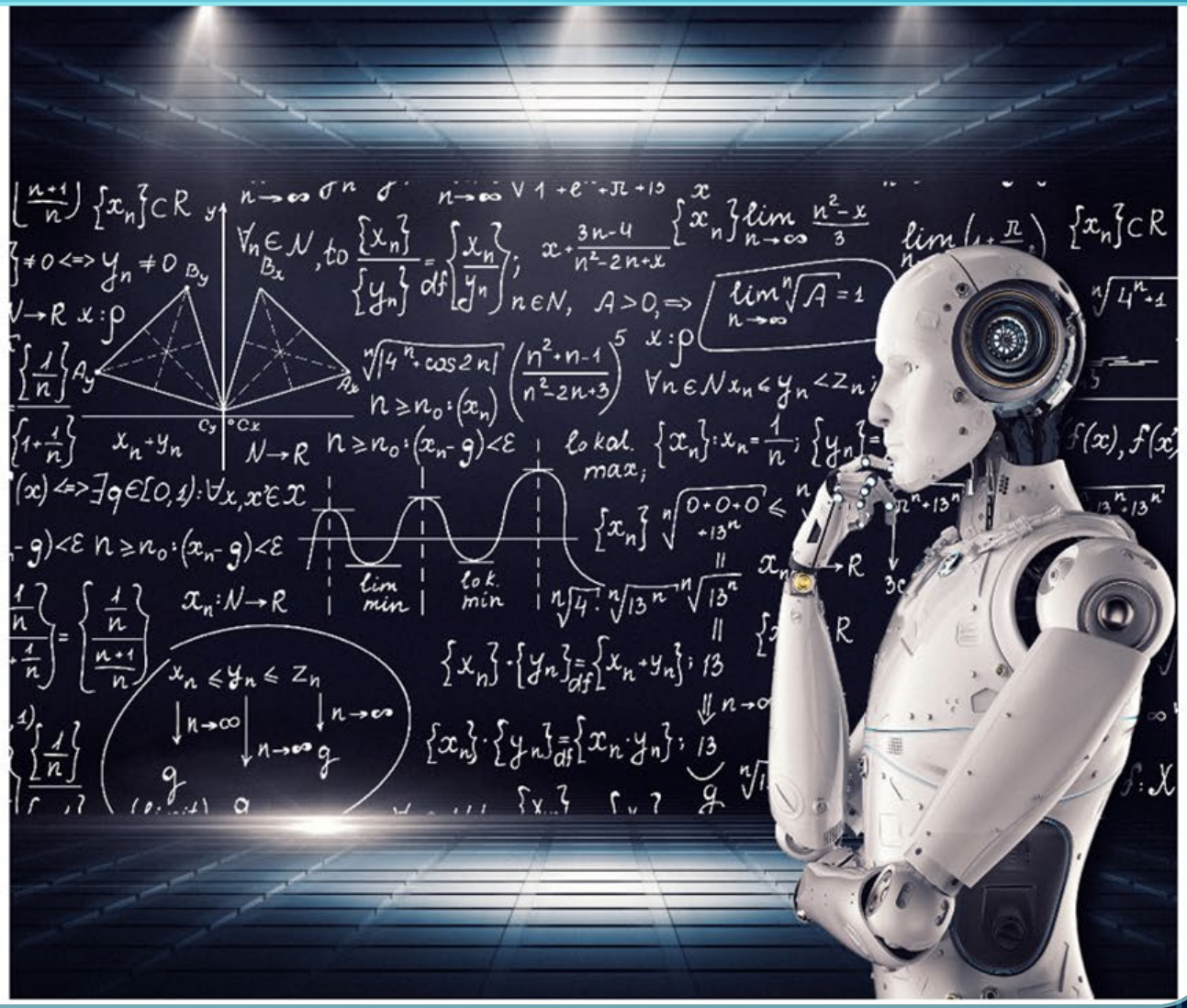
AI INSTITUTE FOR EXCEPTIONAL EDUCATION

Advance **use-inspired** artificial intelligence (AI) technologies to **scale** the availability of SLPs for **universal screening** and **individualized ability-based** interventions

https://invite.illinois.edu/

POPULAR DEPICTIONS OF ARTIFICIAL INTELLIGENCE





THIS ALIEN PRESENCE IS…

- Generative: creative, unpredictable, moody, lazy, naughty
- Social: chatty, interactive, responsive, multi-lingual, empathetic
- Multi-modal: sees, hears, speaks and can interact in all modes
- Integrated: systems, digital ecosystem, IoT, devices
- Multiplying: many model types (LLMs, SLMs, LMMs, LAMs)
- Intelligent: memory, optimisation, speeds, performance
- Improving: learning, growing in capability, becoming more intelligent
- Autonomous: self-improving agents that can act on our behalf
- Ubiquitous: AI is everywhere, including our mobile devices

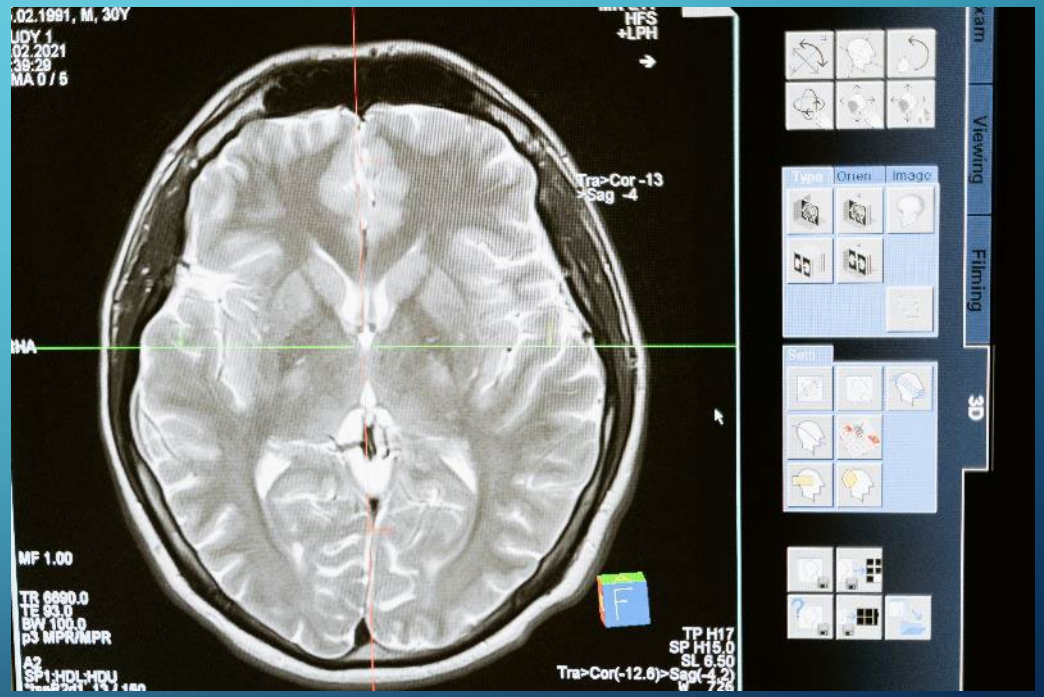
GenAI versus AGI (Artificial General Intelligence)

A LARGE LANGUAGE MODEL (LLM) IS LIKE A DIGITAL PARROT

It can express combinations of sounds/symbols without any understanding of these mean or any capacity to explain how it arrived at what it is articulating

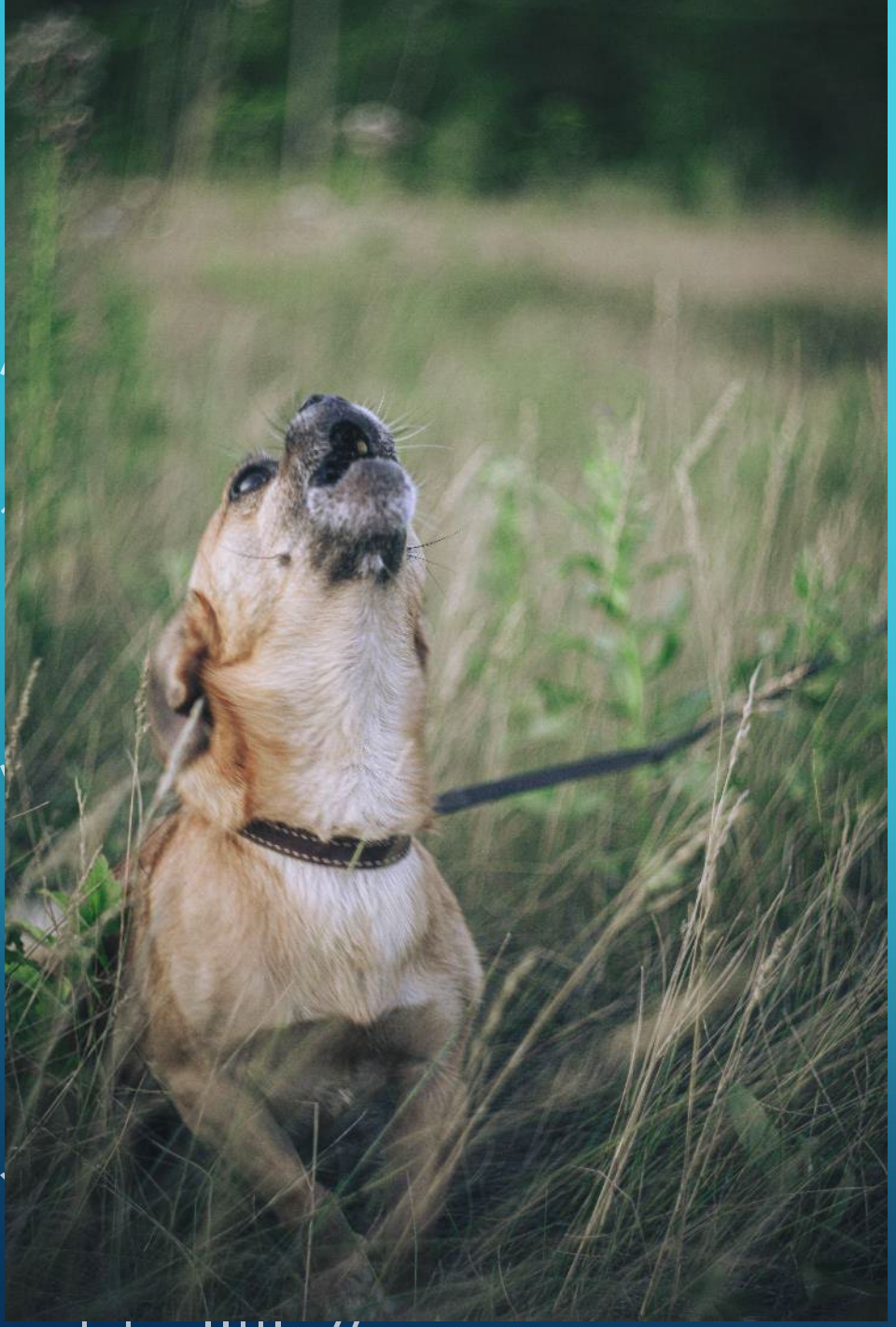
A LLM IS LIKE A BRAIN WITHOUT A MIND

No consciousness, metacognition, agency, senses, experiences, or implicit knowledge of what it is like to have a biological body, a family and friends, a culture, and an ethical system with moral values



A LLM IS LIKE A DISTORTED MIRROR

In reflecting back the artifacts it assimilates from the worldwide web, human biases and misconceptions, uncited use of others' intellectual property, and made-up hallucinations are infused into what the Internet can offer as curated knowledge and insight



PERFORMANCE DOES NOT GUARANTEE EVENTUAL COMPETENCE

One of the "Seven deadly sins of AI predictions" is to assume that basic performance will lead to high competence, given enough time and resources

LLM MAY BE MISUSED TO AUTOMATE OUTDATED MODELS OF INSTRUCTION AND ASSESSMENT

Unless we are wise, LLM may become a type of digital duct-tape to hold together an obsolete industrial-era educational system

OTHER PEOPLE ARE OFTEN A BETTER SOURCE OF KNOWLEDGE AND INSPIRATION THAN AI

A group of peers will bring more diverse perspectives, more creative ideas, and greater social support than a chatbot can.

Article on New Models for HE at Scale

Dede, C., & Lidwell, W. (2023). Developing a next-generation model for massive digital learning. *Education Sciences* 13, no. 8: 845. https://doi.org/10.3390/educsci13080845

Call to Action

love of learning, flexibility, resilience, confidence, initiative, growth mindset