



# NAVIGATING A WORLD OF GENERATIVE AI: SUGGESTIONS FOR EDUCATORS

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# 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.



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

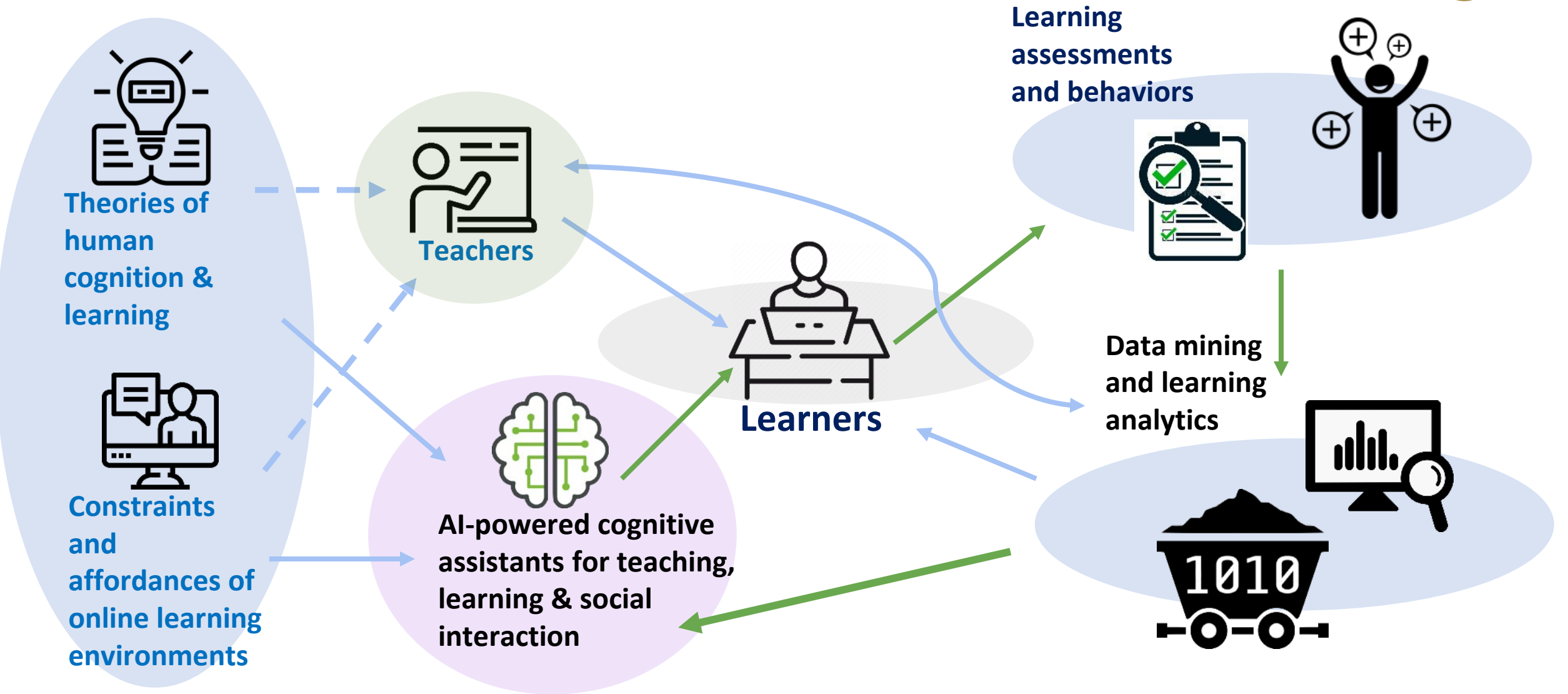
LLM solve the natural language processing problem (NLP)

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

Fluent verbal and textual communication



# AI-ALOE Vision: Virtuous Feedback Loop between Learners, Teachers, Researchers, and AI Technologies



<https://aialoe.org/>

**Use-Inspired**

**Foundational**

**Technological**

*Cognitive engagement  
Teacher presence  
Social interaction*



*Personalized feedback  
Mutual Theory of Mind  
Machine Teaching*

**Methodological**

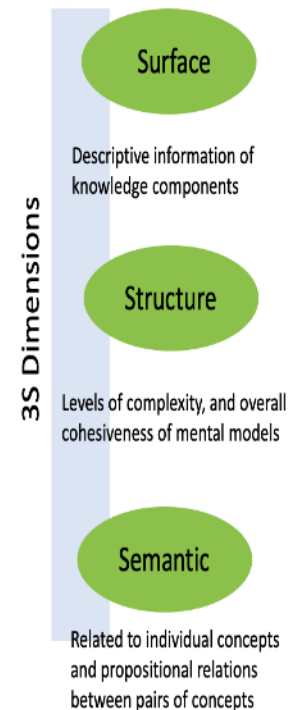
*Feedback loops among  
teachers, learners, and  
AI agents*



*Participatory design for  
Responsible AI*

# 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)

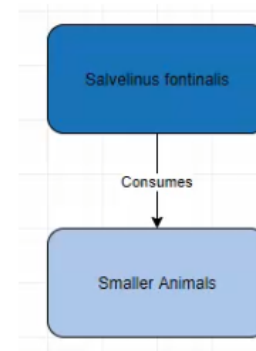
		English			Biology
		Summer	Fall	Total	Fall
<b>Surface</b>	S-Number of Concepts	11.84	32.12	45.280	
	S-Number of Relations	20.36	54.14	81.54	12.41
	S-Density	6.3	17.38	25.94	
<b>Structure</b>	S-Average Degree		7.86	14.36	14.33
	S-Mean Distance		14.68	19.98	
	S-Diameter		6.58	10.59	
<b>Semantic</b>	Concept 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.

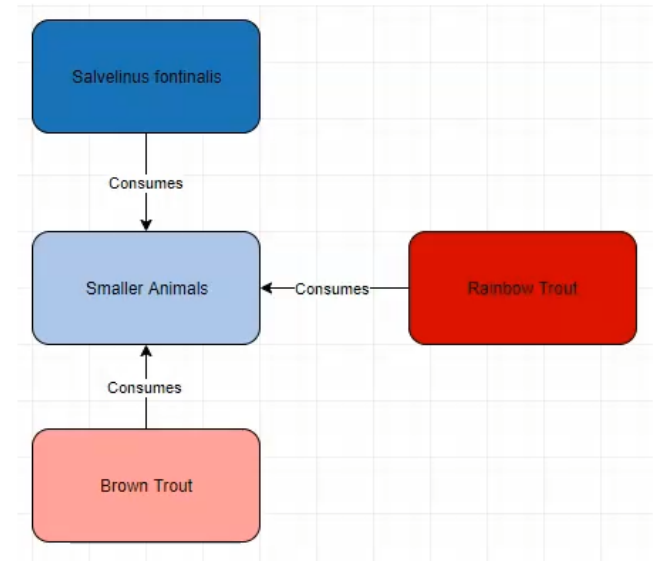
# VERA for Enhancing Model Learning

- 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.*

Phase 1 Model Example



Phase 2 Model Example



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





# BEGINNING FRENCH II CURRICULUM

- **What does it mean to be Parisian?**
  - Discussions of the diversity of Paris
- **Lodging and housing in Paris**
- **Famous love stories in Paris** (love during Covid19, cliches of Paris as the city of love, etc.)
- **Quarters of Paris**
  - Marais, Montmartre, Latin Quarter, Belleville, Goutte d'Or, 11e/la République
- **Les Beaux-Arts (Fine Arts): \*\***
  - Music: Fête de la Musique in Paris
  - Theater: Comédie Française (*Le Malade Imaginaire*)
  - Art: Surrealism and modern art at the Centre Pompidou /Graffiti in Paris
- **Media: Representations of Paris in Media (Gilets Jaunes/Covid19)**



**DAY 6:**  
**SURREALIST CRIME AT THE**  
**CENTRE POMPIDOU**

- Linguistic function Express opinion, emotion, doubt, and certitude
- Theme: Who committed the surrealist crime at the Centre Pompidou?
- Grammar review Subjunctive



# AI AS CHARACTER

NICOLE MILLS & ARNAUD DRESSEN  
COLLABORATION WITH WONDA VR AND REVE STUDIOS



<https://www.colorado.edu/research/institute/>





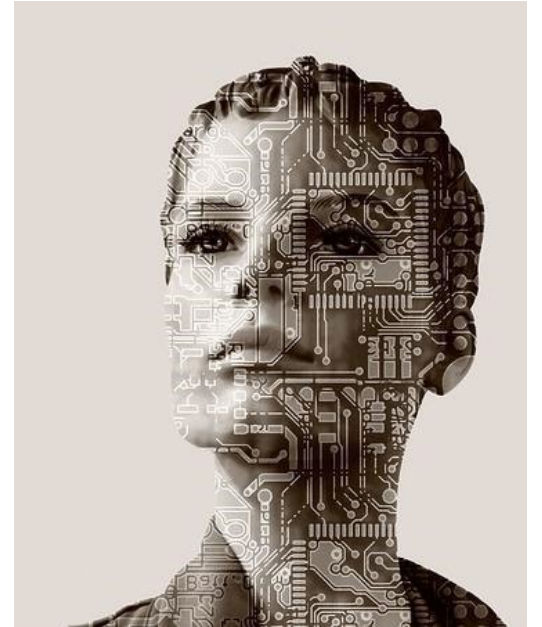
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# POPULAR DEPICTIONS OF AI

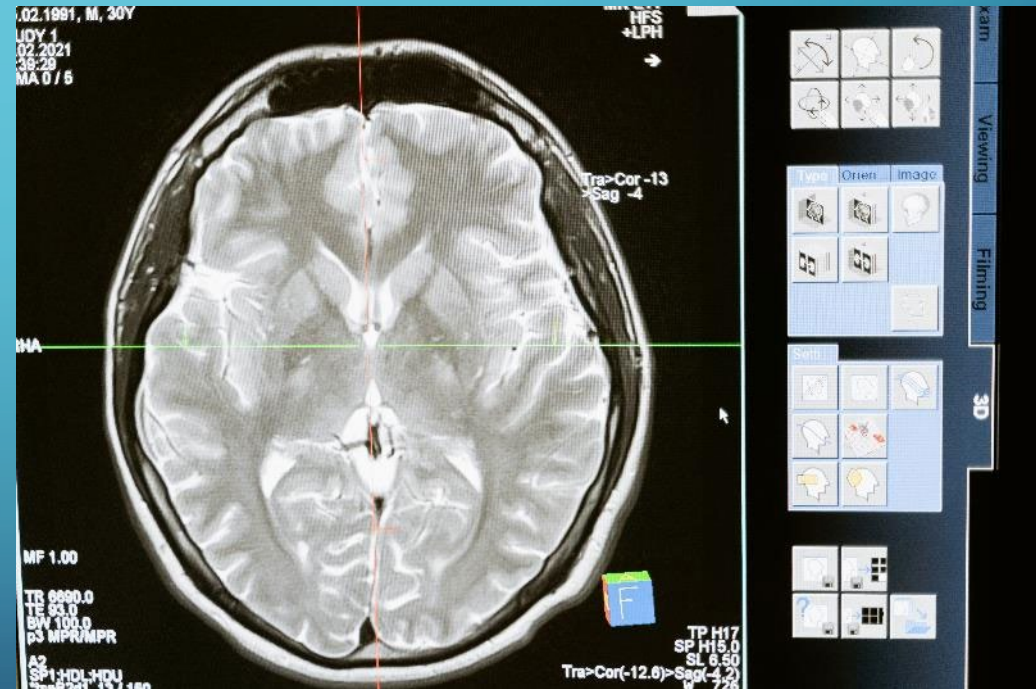
# A LARGE LANGUAGE MODEL (LLM) IS LIKE A DIGITAL PARROT

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

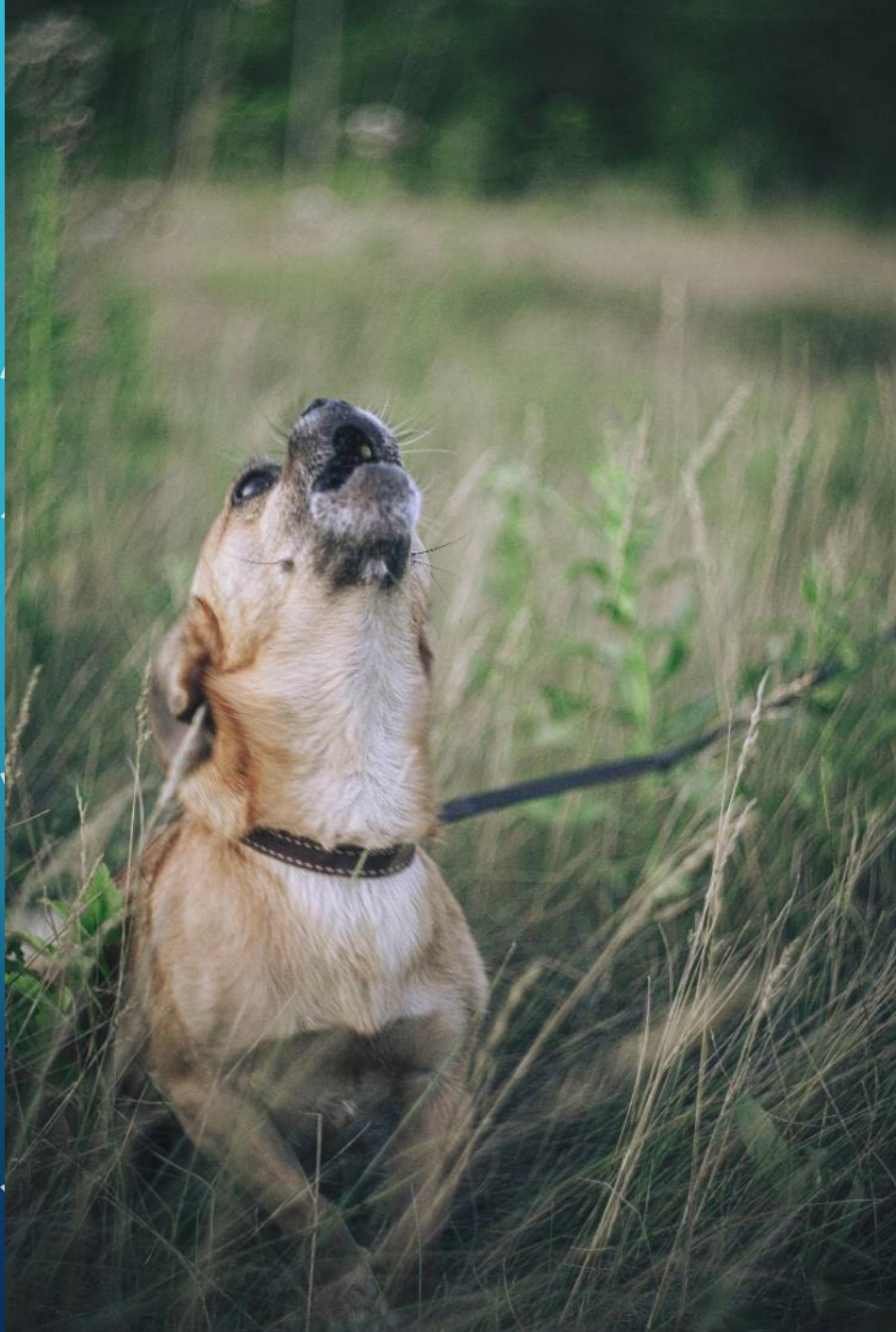




## A LLM IS LIKE A DISTORTED MIRROR

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

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

**Properly controlled**, LLM are good at “reckoning” (calculative prediction) to complement human strengths in “judgment” (practical wisdom)



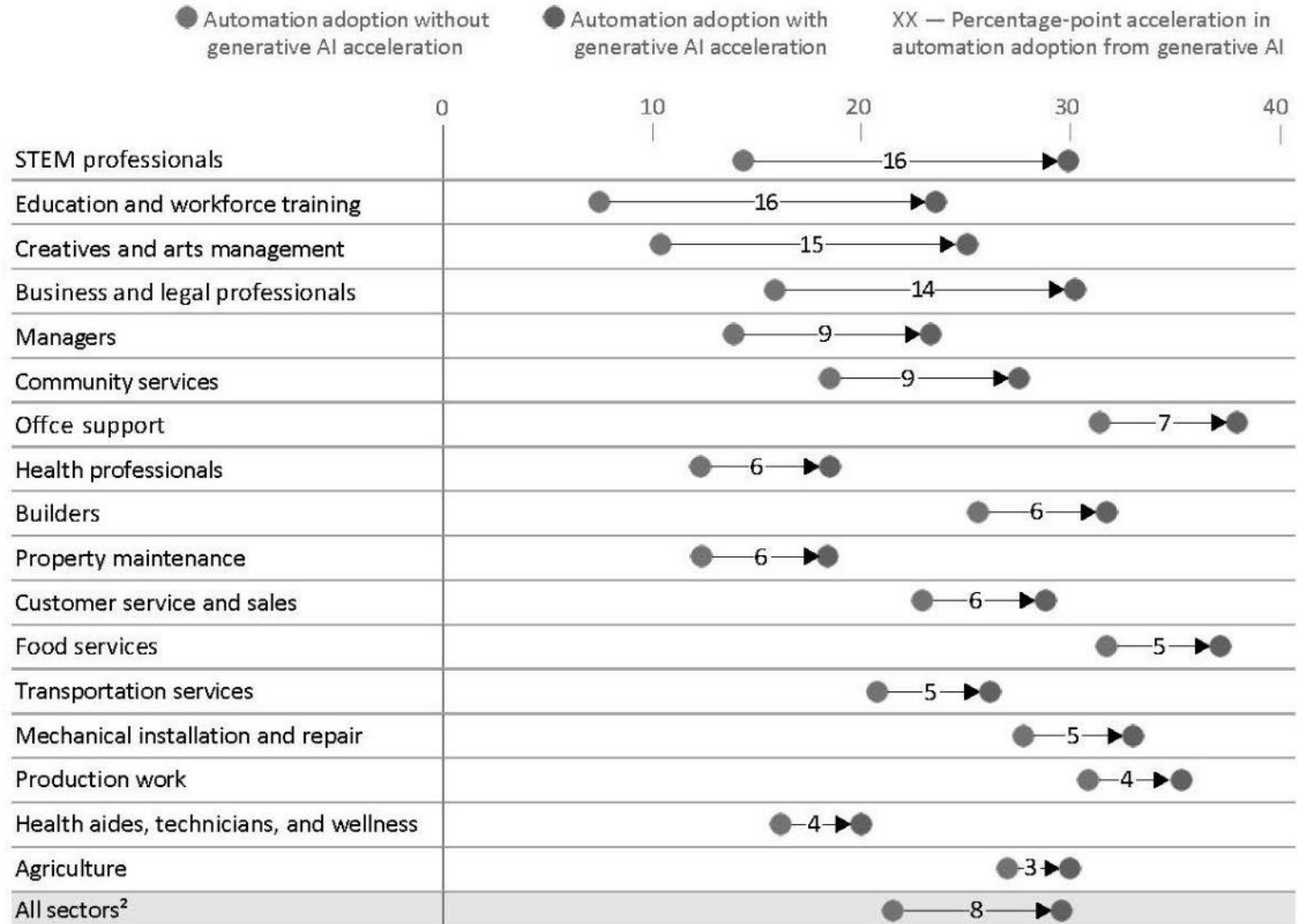
# INTELLIGENCE AUGMENTATION

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- 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**

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

Midpoint automation adoption<sup>1</sup> by 2030 as a share of time spent on work activities, US, %



<sup>1</sup>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.

<sup>2</sup>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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# RECKONING VERSUS JUDGMENT

## Reckoning is calculative prediction

Programs that can estimate the life expectancy of a particular cancer patient, given their characteristics, the specific disease, and available treatments

## Judgment is practical wisdom

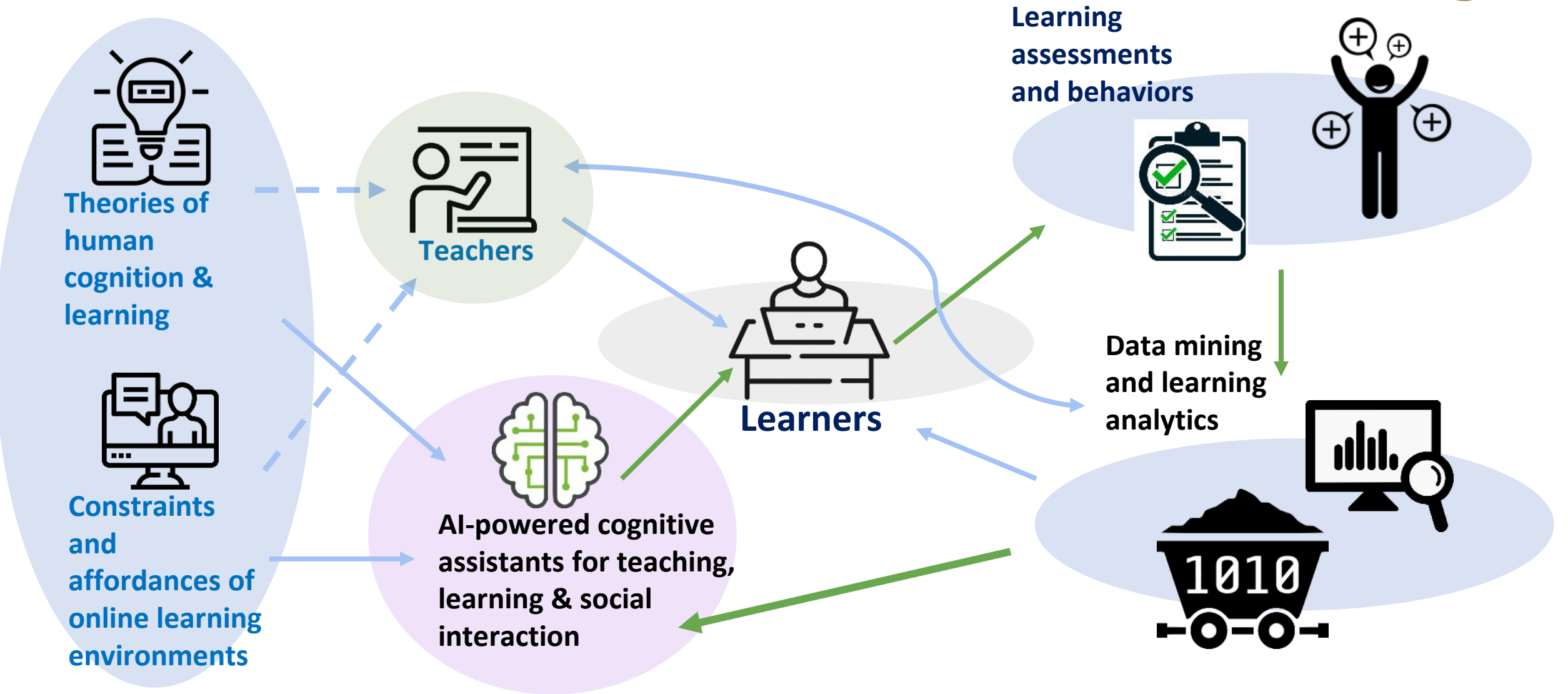
Healthcare workers counseling cancer patients can help them choose treatment options, factoring in quality of life versus life expectancy, tolerance for pain, personal and cultural beliefs about death, family circumstances, spiritual beliefs

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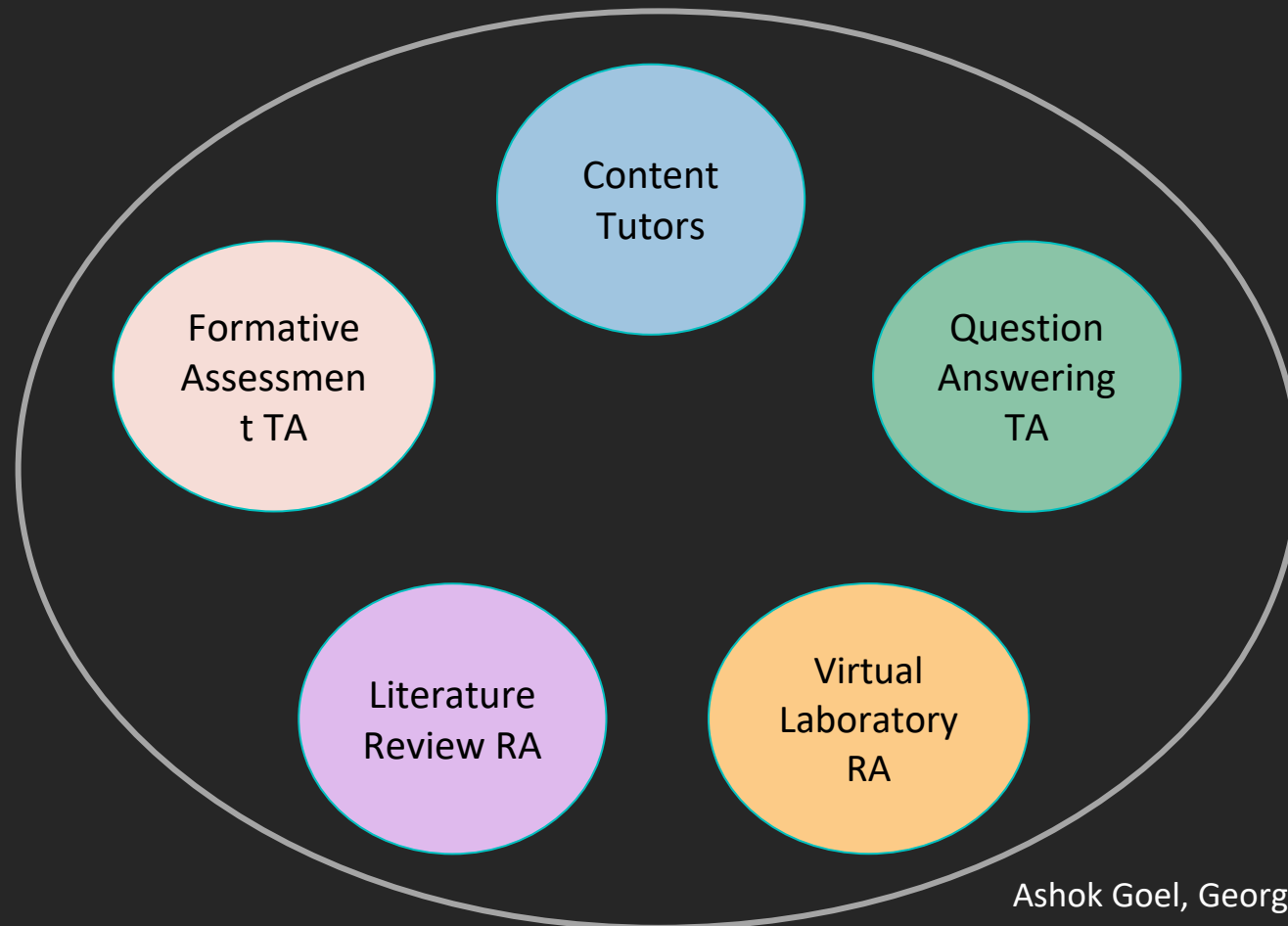
# AI-ALOE Vision: Virtuous Feedback Loop between Learners, Teachers, Researchers, and AI Technologies





# A COORDINATED SUITE OF AI TECHNOLOGIES

(based on functional roles of human teachers)



# INTELLIGENCE AUGMENTATION

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



## Machine Learning and Human Intelligence

The future of education for the 21st century

Rosemary Luckin

<https://tinyurl.com/4dbymeew>  
[HTTPS://TINYURL.COM/4DBYMEEW](https://TINYURL.COM/4DBYMEEW)



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## Intelligence Augmentation: Upskilling Humans to Complement AI

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

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Chris Dede, Ashley Etemadi, and Tessa Forshaw



# 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





# What Can Educators Do?

# What can educators do?

## Demystify AI

Demystify AI: Teach learners the nature of generative AI

## Focus on the process

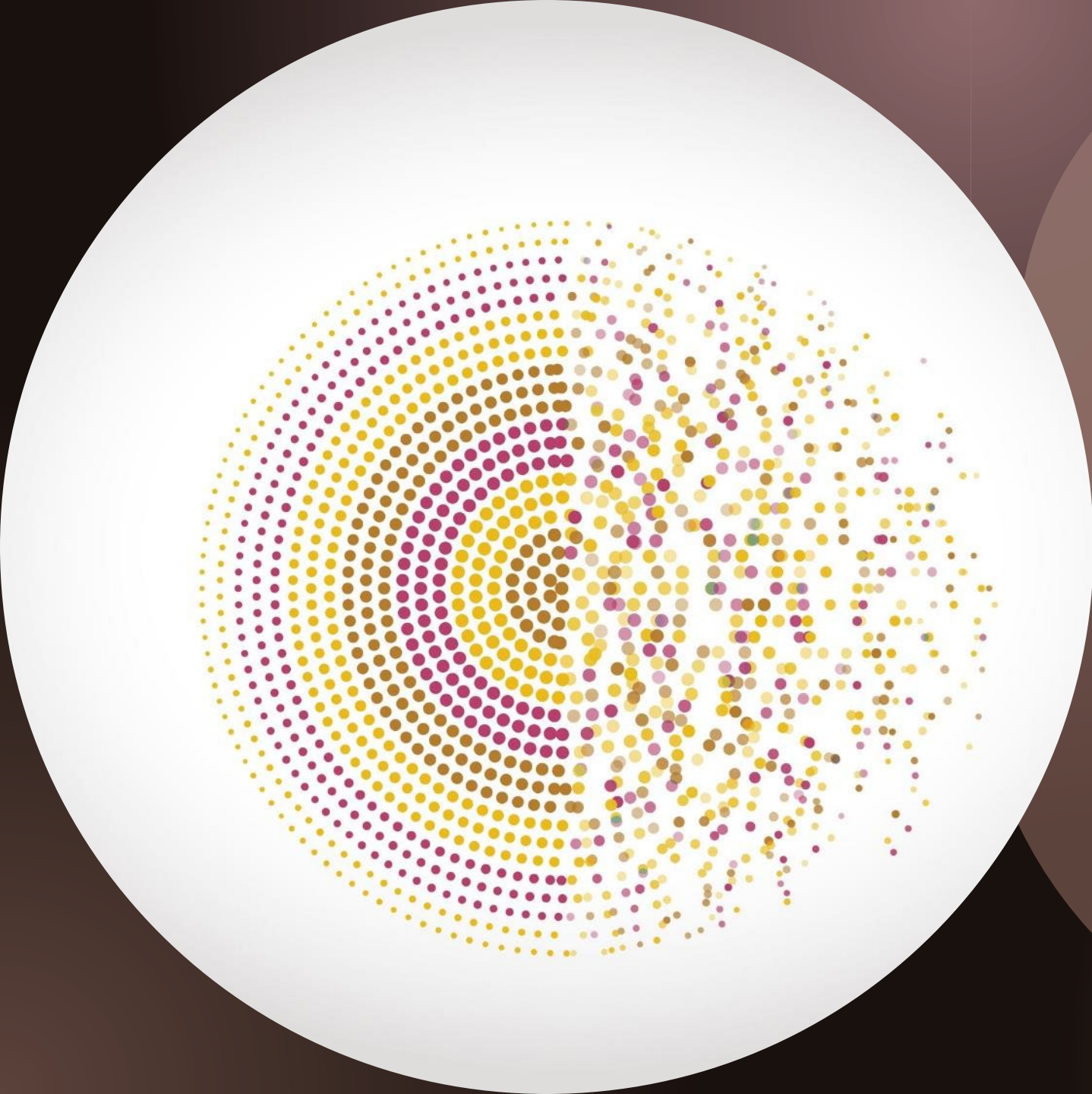
Focus on the process of learning rather than just the product

## Honour agency

Honour learner agency and orchestrate multiple sources of motivation

## Cultivate IA

Cultivate skills that AI cannot do



1. Demystify AI:  
Teach learners  
the nature of  
generative AI



# Make abstract concepts accessible through analogies

- Parrot
- A brain without a mind
- Moonlight
- Mirror



Create  
experiential  
learning  
opportunities



## MIT AI LITERACY UNITS

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If you are an educator who wants to bring AI Literacy to your school, please check out our professional development opportunities.

### GAN Play



Learn about GANs by playing with pix2pix Image Transfer!

[★ READ MORE](#)

### The A-Z of AI



## Artificial intelligence

This A-Z guide offers a series of simple, bite-sized explainers to help anyone understand what AI is, how it works and how it's changing the world around us.

### Python Like You Mean It



Python Like You Mean It was created to teach Beaverworks students how to code in Python in preparation for work in STEM.

### Elements of AI



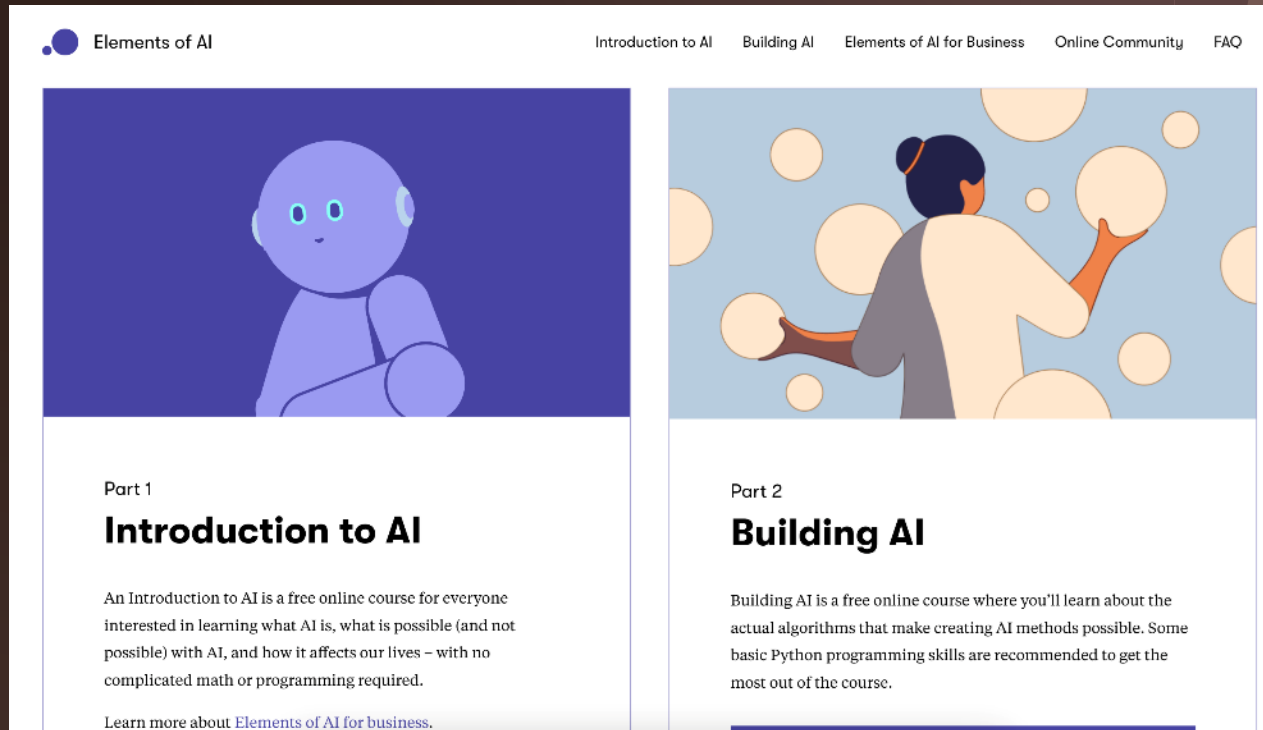
The Elements of AI is a series of free online courses created by Reaktor and the University of Helsinki.

[★ READ MORE](#)

# Resources for AI literacy

- RAISE (Responsible AI for Social Empowerment and Education), an initiative of MIT
- CRAFT (Classroom-Ready Resources About AI For Teaching) at Stanford University

# Element AI



The screenshot shows the Element AI website with a navigation bar at the top containing links for 'Introduction to AI', 'Building AI', 'Elements of AI for Business', 'Online Community', and 'FAQ'. Below the navigation bar are two course cards. The first card, 'Part 1 Introduction to AI', features a blue robot illustration and a description of a free online course. The second card, 'Part 2 Building AI', features an illustration of a person with orange gloves and a blue background with yellow circles, and a description of a free online course focusing on algorithms and Python programming.

Elements of AI

Introduction to AI Building AI Elements of AI for Business Online Community FAQ

Part 1

## Introduction to AI

An Introduction to AI is a free online course for everyone interested in learning what AI is, what is possible (and not possible) with AI, and how it affects our lives – with no complicated math or programming required.

Learn more about [Elements of AI for business](#).

Part 2

## Building AI

Building AI is a free online course where you'll learn about the actual algorithms that make creating AI methods possible. Some basic Python programming skills are recommended to get the most out of the course.

- A series of free online courses about the fundamentals of AI and how to build AI systems.



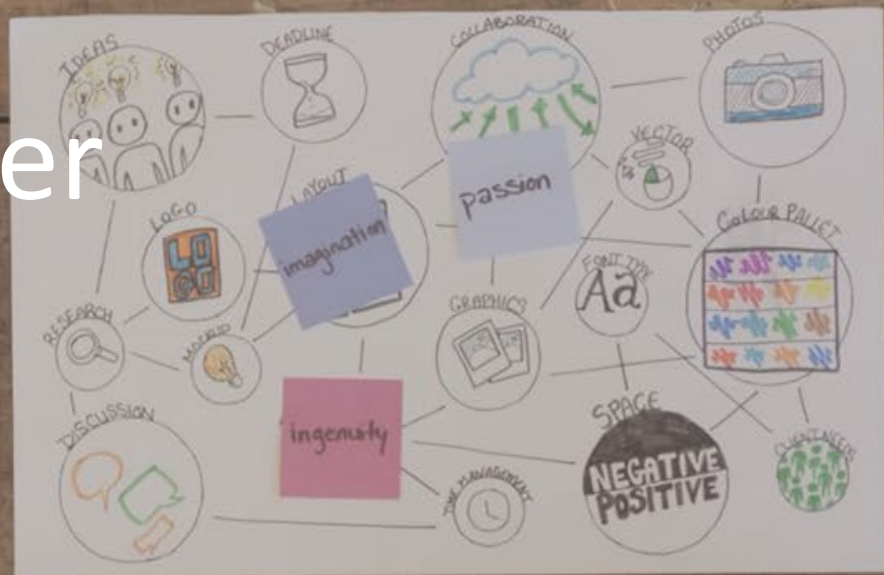
# Unpack learning and thinking via discussion

- Do not jump into quick solutions
- Instead of funnelling student ideas to a predetermined direction, create favorable conditions for collective interaction and push students to advance their thinking together.

# Resources to orchestrate productive discussions

- [NSRF Protocols](#)
- [Talk moves](#)
- [Toolkit for Systematic Educational Dialogue Analysis \(T-SEDA\)](#)

2. Focus on the process of learning rather than just the product



A hand holding a magnifying glass over a forest with bokeh light effects. The background is a soft-focus forest with warm, golden-brown light filtering through the trees, creating a bokeh effect of bright, out-of-focus circles. The magnifying glass is held in the foreground, focusing on a specific area of the forest floor, which appears to have some small, glowing blue-green spots. The overall mood is contemplative and focused.

# Slow down

- Emphasize the process of learning by encouraging students to slow down
- Attend to the complexity and relationships that are often overlooked (Tishman, 2017).



## Parts, People, Interactions

Identify a system and ask the following questions.

What are the **parts** of the system?

Who are the **people** connected to the system?

How do the people in the system **interact** with each other and with the parts of the system?

How does a change in one element of the system affect the various parts and people connected to the system?

## Slow Complexity Capture - Find, Capture, Explain, Wonder

*A routine for slowing down to look closely at complexity.*

**Find:** Find an object or scene that captures your eye. In a word or phrase, say what it is.

**Capture:** Take some time to look carefully at your item. Capture it by slowly making a drawing of it or taking pictures of it from different angles or perspectives. Don't worry about creating a 'good' or realistic drawing or picture. The goal is to use drawing or picture-taking to help you look closely and notice details. Spend at least 5-10 minutes observing through drawing, looking, and/or photographing.

**Explain:** After you have visually captured your item, write a paragraph (or tell a friend) about how it is complex.

**Wonder:** What new ideas and questions do you have about your item?

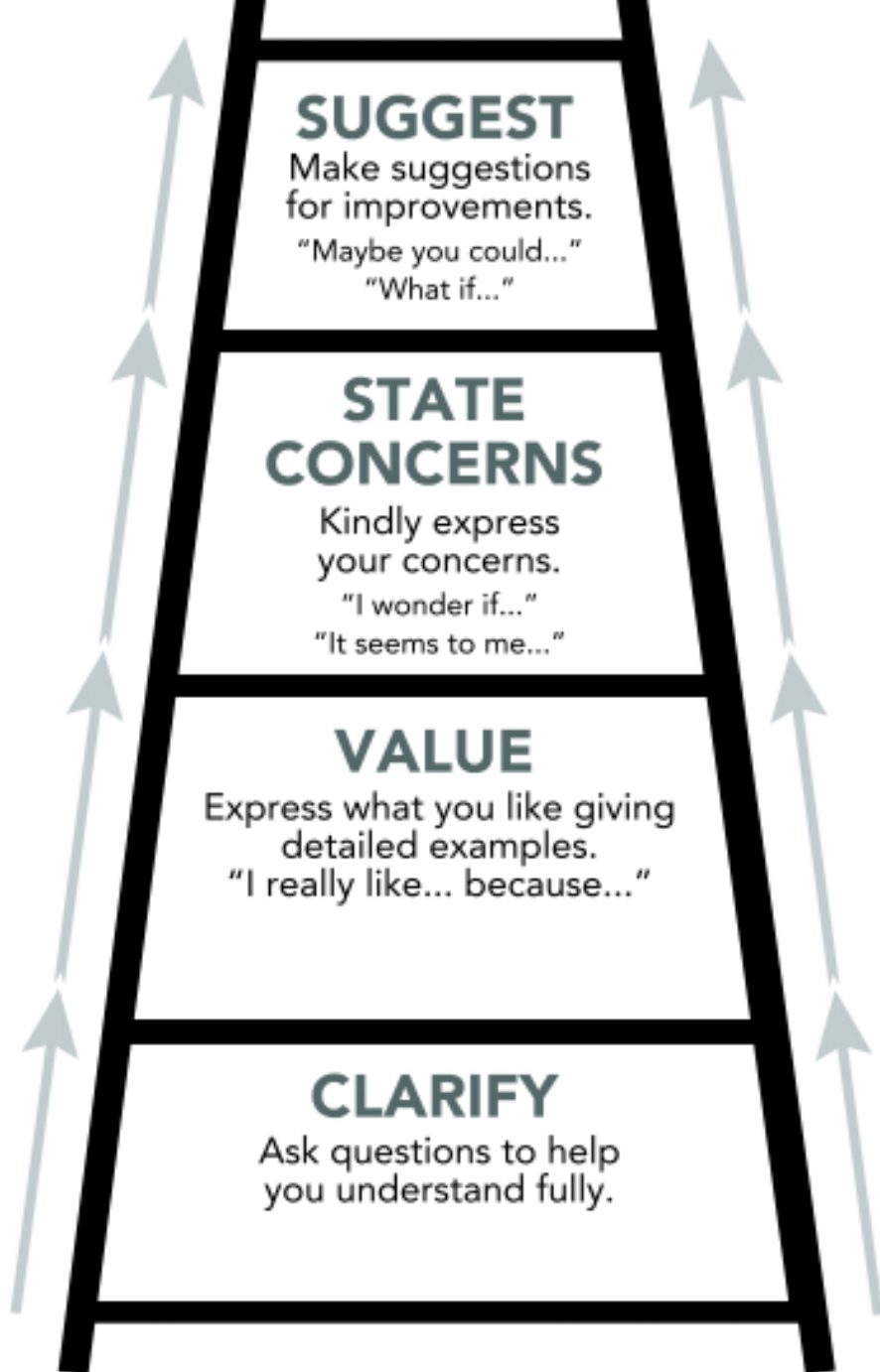


# PZ thinking routines

# Make thinking visible

- Design assignments that create space for learners to showcase their work-in-progress
- Verbal and non-verbal
- Provide multiple interim check-in points for reflection and informal feedback.





# Informative feedback

- Feedback should be specific and informative
- Feedback involves both cognitive and affective dimensions
- Strategies such as [ladder of feedback](#) could be helpful in constructing productive feedback.



# Ask AI for feedback

- Recognizing the limitations of generative AI mentioned earlier (e.g., lacking comprehension), the usefulness of the feedback provided by AI may vary.
- This provides an opportunity for learners to hone their critical thinking and judgment skills by evaluating AI-generated content through reflection and discussion.
- In this way, AI is not doing the thinking for the learners, but supporting them to think better.

# Build learners' capacity to monitor their own learning

- Positioning learners as active seekers and processors of feedback rather than as passive recipients (see [Xu & Grotzer, 2022](#), [Cuzzolino & Grotzer, 2022](#)).

# Collective intelligence

The whole is greater than the sum of its parts



# Teach students how to give each other feedback



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Gallery walk



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Fish bowl

# Design group-worthy tasks

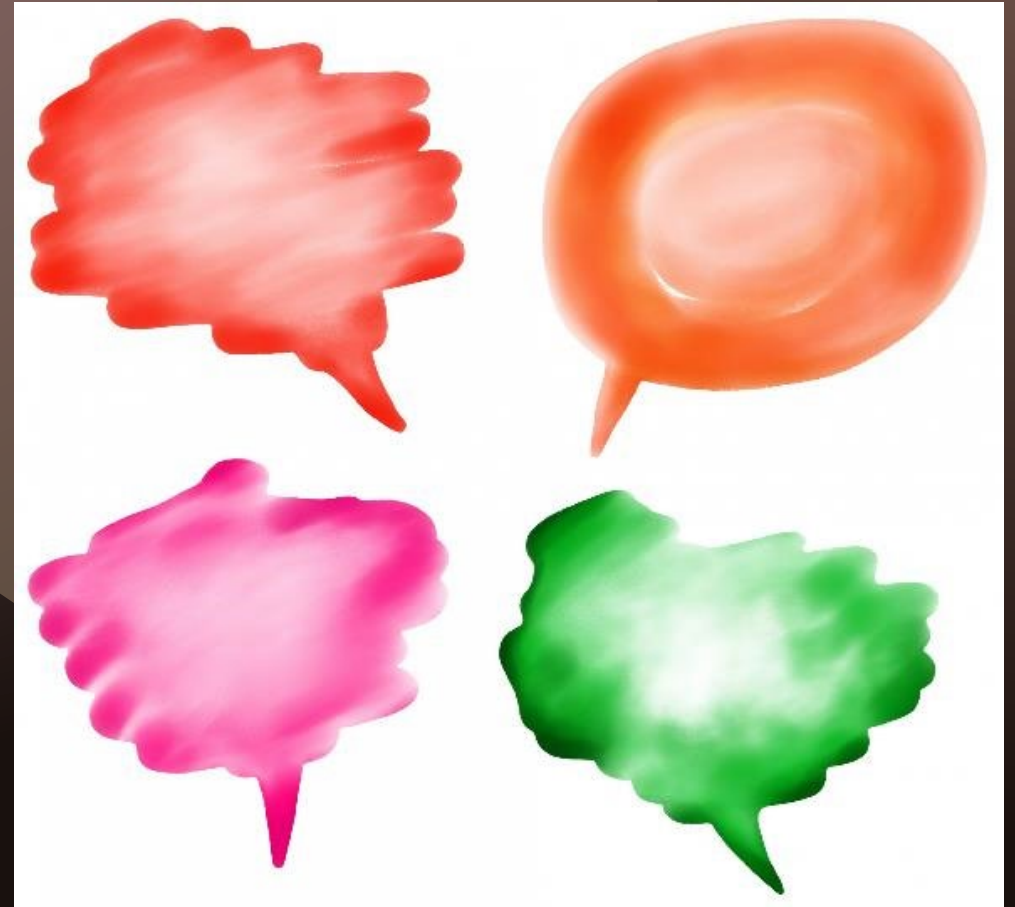


- Design group-worthy tasks rather than tasks that can be easily completed by individuals or divided among team members.
- Genuine dilemmas and authentic tasks (Lotan, 2003), where student share their lived experiences, explore different beliefs and opinions, gently challenge each other, build consensus, and "rise above" their previous ideas and create new collective knowledge.



# Position AI as a dialogue partner rather than product producer

- Instead of perceiving generative AI as the one who “knows the answer”, a more productive way is to view it as a “dialogue partner”.
- Build on, critique, question, and rise above AI-generated ideas to create new ideas





# Ask better questions

- Generative AI depends on the prompt or the question that was asked.
- If a learner has not yet developed enough prior knowledge to have the language to articulate the problem, the response might not be helpful.
- Support learners to build foundational knowledge and a roadmap to navigate the terrain of learning.
- Stanford Smile: <https://portal.smile-pi.org/smile/>
- Evaluate the level of the question based on Bloom's taxonomy to push learners to ask better questions.



## ‘Facing an empty canvas’ vs. ‘building on AI-generated ideas’

- Developing the metacognitive skill of discerning when, where, and how to use AI will be crucial.
- Experiment with AI rather than banning it.
- Through experimentation, open discussion, and learning about the workings of AI, learners can become mindful users and creators of AI.

### 3. Honour learner agency and orchestrate multiple sources of motivation



# Plagiarism



phillipmartin.info

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- The issue of plagiarism is not new though it has certainly been intensified by generative AI.
- Why do learners plagiarize?
- "Nobody plagiarizes in their diary." That's true, since plagiarism would defeat the purpose of writing a diary, which is a *process* of self-expression. People write diaries not because they *have to*, but because they *want to*.



# Humans are intrinsically motivated to learn

- Children ask around 10,000 questions each year in the process of spending one hour each day in the company of a familiar caregiver (Harris, 2015)
- Traditional education often uses levers for extrinsic motivation, such as giving students awards and norm-referenced grades.
- What we ought to be more concerned about is to rekindle students' love for learning and intrinsic motivation.

# Why do we learn what we learn?

- Learners often engage in learning without necessarily understanding the purpose or establishing personal relevance.
- Get to know your learners by understanding what motivates them and creating spaces for learners to reflect on their purpose of learning.
- “What is something that you do on a regular basis that you do because you enjoy it so much, that you keep coming back to it?” (see [Dede, 2022](#)).
- Provide choice and autonomy in learning and empower learners to pursue topics with entry points that they are genuinely interested in (see [Grotzer 2021](#)).

# Intrinsic motivation is not a panacea

- It does not prevent failures or frustration.
- In fact, for any learning to take place, learners have to be at the edge of their competency (Bereiter & Scardamalia, 1993).
- We are not intrinsically motivated by everything.



# Engineer an ecosystem of motivations

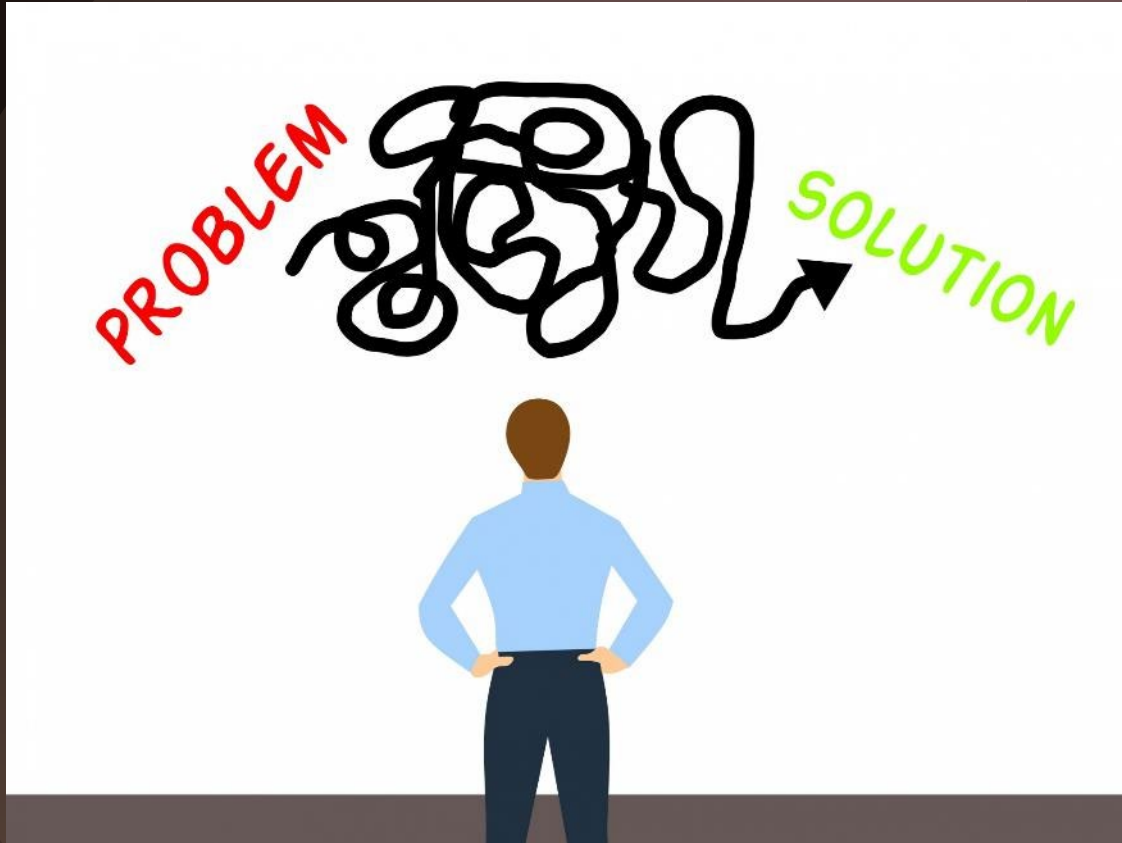
- Motivation is not something we either have or do not have; it is a complex, multifaceted, and dynamic process.
- There is not a one-size-fits-all recipe.
- We should also consider learners self-regulation, executive function, beliefs (including self-efficacy, growth mindset, and stereotype threat), habit-building, and academic dispositions such as tenacity and resilience.
- Encourage learners to be metacognitive about their own motivation, document and reflect on their learning process, monitor their own state of emotion, and pro-actively seek, create or modify conditions that best support them (see work on [Fast Fish Learner](#)).

4. Cultivate  
skills that AI  
cannot  
perform



# Recall - Judgment vs. Reckoning

- The current curriculum and tests often prioritize fostering skills that AI excels at, such as *reckoning skills* involving calculative prediction and formulaic decision-making.
- AI cannot easily replicate human judgment *skills*, which is a deliberative thought process that is flexible and contextual based on experiential knowledge, ethics, values, relationships, and culture (Dede et al., 2021).



# Teach for IA

- Presenting genuine and authentic real-world problems that are ambiguous, complex, and multidisciplinary without one single solution.
- E.g., design community-based solutions for mitigation and adaptation for climate change



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- Learners can experiment with partnering with AI during problem-solving and design.
- For instance, learners may leverage AI's reckoning skills, asking AI to summarize the precipitation and average temperature trend in their community over the past 50 years and cross-check with meteorological data from various sources.
- At the same time, learners can exercise their judgment skills by incorporating their lived experience and understanding of the local culture to design effective solutions that have buy-in from the local community.

# What does it meant to partner with AI?

- A lack of regulations and understanding on what it means to partner with AI.
- Educators and learners can contribute to the ongoing debate and discussion by documenting their experience with AI and providing examples of human-AI partnerships.

# Conclusion

- AI differs fundamentally from human intelligence, lacking essential qualities such as comprehension, self-awareness, emotions, embodiment, ethics, values, and culture.
- Demystifying AI
- Emphasizing the learning process over the final product
- Honouring learner agency, orchestrating multiple sources of motivation
- Cultivating skills that AI cannot easily replicate and fostering intelligence augmentation (IA) through experimenting with human-AI partnerships.

Harness the benefits of AI while nurturing the unique abilities of humans to tackle big challenges in the 21<sup>st</sup> century.

# Thank you!



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