From algorithm worship to the art of learning: insights from 50-year journey of AI in Education

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This Talk

Structure

- The claims

- The challenges

- The knowledge

- The way forward

Take home points

AI in education (AIED):

- is a mature field of research

- searches for and delivers evidence of educational efficacy and effectiveness

- can and should inform AI discourse and practices

- points a way forward for how we can nurture the art of learning by examining what, how and why we learn and teach.

Claim: AI an inflection point for humanity

e.g. Crawford, 2017

Hopes vs. Fears for AI applications

HOPES

- Unlocking scientific mysteries for advancing healthcare

- Making the world a safer place

- Addressing global challenges

FEARS

- Ethical implications of AI

- Narrowing of opportunities for learning and rehearsal of fundamental capacities

- Fundamental changes to human capacities

Hopes vs Fears for AI applications in Education

HOPES

- Innovating Education

- Delivering learning at scale across different contexts

- Addressing global teacher shortages and funding challenges

FEARS

- Ethical implications of AI for individuals and society

- Narrowing of education curricula, e.g. to STEM subjects

- Over-standardisation

- Fundamental changes in perception, beliefs, and social interactions

Wider Rhetoric about AI in Education

Education

- Teacher shortages

- Efficiency of teaching and learning
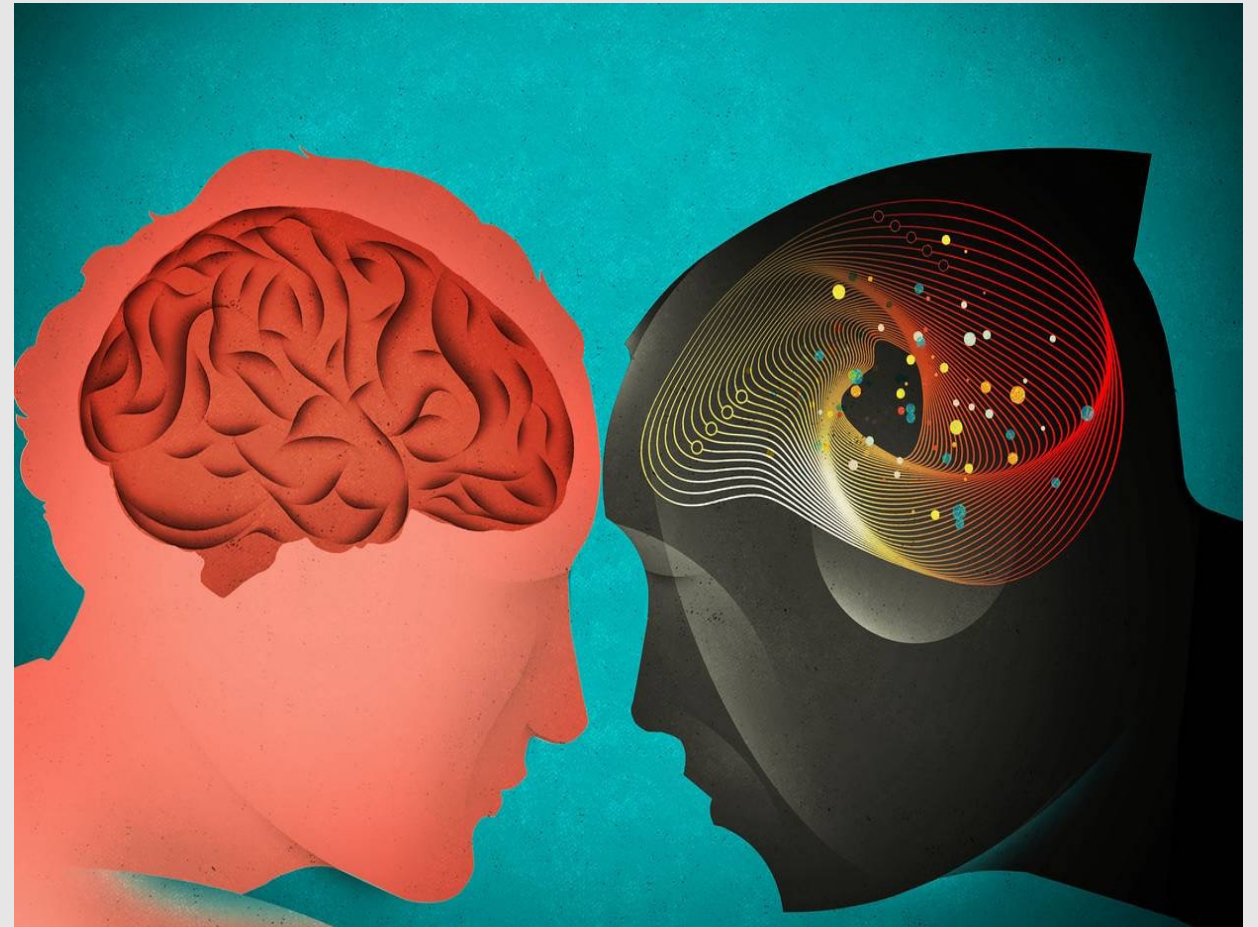
- Measurability

Economics

- AI is big money!

- EdTech is a fast emerging industry

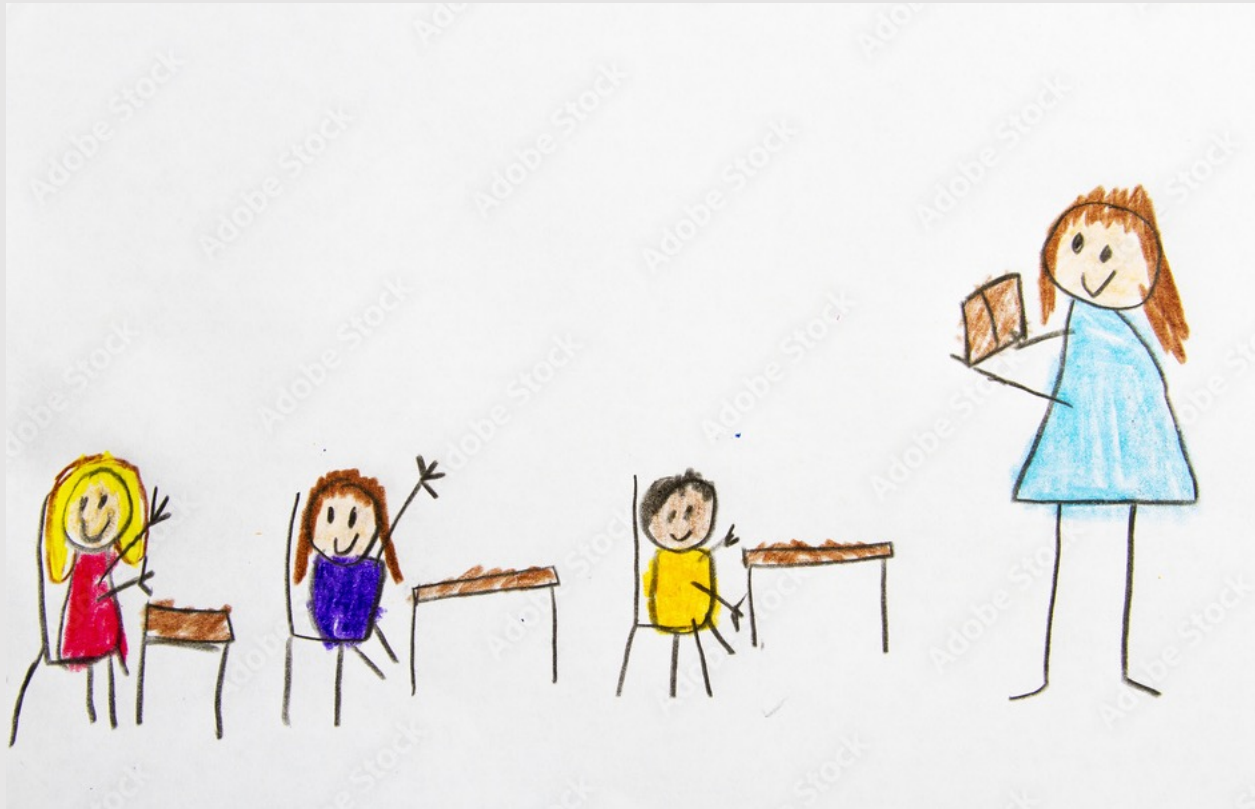# The Problem:
» Over-generalisation & insufficient expertise

Typical AI Myths

- AI = human
- AI = HI
- AI = robots
- Machine learning = human brain
- AI = machine learning
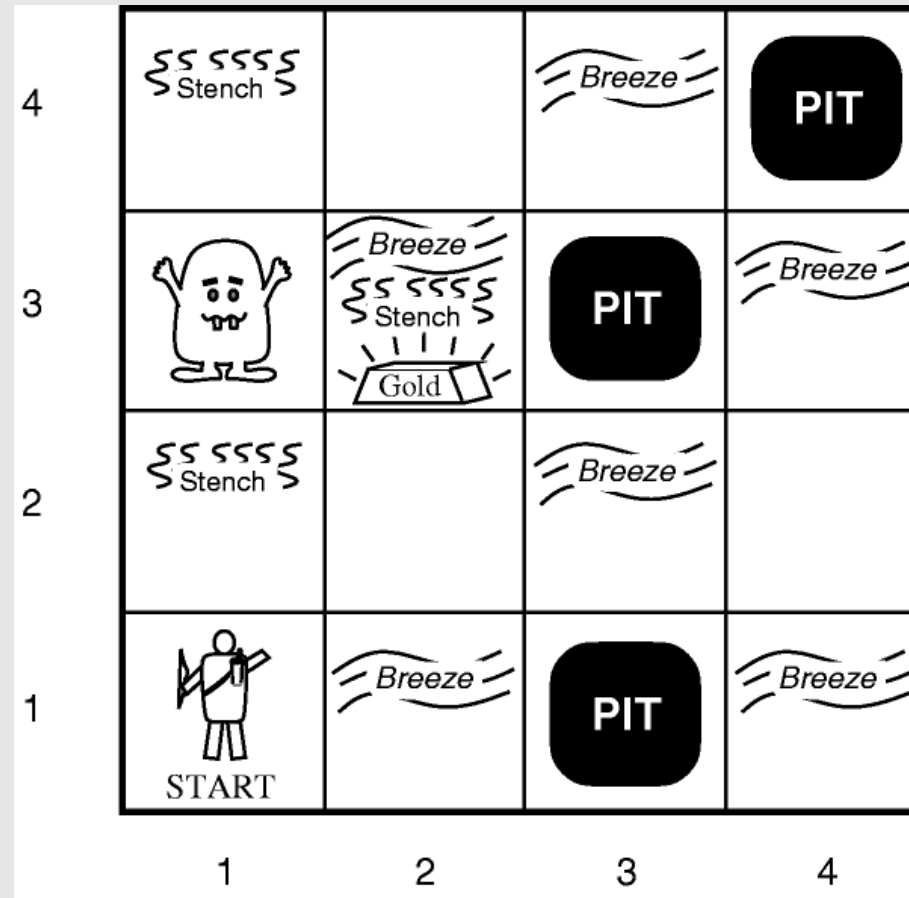- AI = chatGPT
- ChatGPT = LLMs
- …………………………????

Over-generalization of AI and Education constructs

Education is not a WUMPUS Problem

Russell & Norvig, 1995

Wrong or narrow or no expertise

Support Guardian Europe
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The Guardian

News Opinion Sport Culture Lifestyle More ▾

Education ▸ Schools Teachers Universities Students

Artificial intelligence (AI)

⊘ This article is more than 3 months old

AI likely to spell end of traditional school classroom, leading expert says

Exclusive: Prof Stuart Russell says technology could result in 'fewer teachers being employed – possibly even none'

Hannah Devlin *Science correspondent in Geneva*

🐦 @hannahdev

Fri 7 Jul 2023 06.00 CEST

📷 Students using laptop computers to study in class. Russell said AI technology could feasibly deliver 'most material through to the end of high school'. Photograph: Ben Birchall/PA

Recent advances in AI are likely to spell the end of the traditional school classroom, one of the world's leading experts on AI has predicted.

THE TIMES
THE SUNDAY TIMES

What Cottesmore School can expect from their new AI chatbot deputy head

The £32,000-a-year private school in Sussex has appointed a robot to the top job. Stuart Heritage imagines what teaching will look like

Cottesmore School, has an AI-generated deputy head, Abigail Bailey

Stuart Heritage
October 17 2023, The Times

Pupils at the £32,000-a-year Cottesmore School in West Sussex have been welcoming their new principal head teacher, an AI chatbot named Abigail Bailey. Bailey, it has been reported, was commissioned and designed to work alongside the school's human headmaster, Tom Rogerson, filling some of his more tedious roles. However, this seems like the start of something seismic. It is now only a matter of time before all our children will have AI teachers. When that day arrives, these are the sort of letters from school we can all expect to receive.

Dear parent,

We are excited to announce our syllabus for the coming term. As AI-powered teachers, we have been able to absorb the entire internet, and for the first time are able to teach your children with the sum total of all human knowledge. As such, maths lessons will now consist of cutting-edge quantum equations. Science lessons will be spent creating fusion technology, giving the planet free and clean limitless power. And thanks to Twitter, all history lessons will now revolve around the theme of "Why Hitler wasn't actually as bad as people make out".

Yours sincerely,
Teachbot 2000

Dear parent,

Please may we remind you to label every item of your child's school uniform? We have amassed an abundance of jumpers, PE kits and coats in our lost property cupboard. Without clear name tags, we are unable to return these to the correct person. Furthermore, lack of identification makes it much harder to strip-mine the children's uniforms of skin and hair samples, a procedure we now undertake to map their DNA so that we can create the species that will eventually come to replace humanity. Any help with this would be greatly appreciated.

Yours sincerely,
Teachbot 2000

● AI threat to creative industry is worrying, says JK Rowling's agent

The Knowledge: Neither Education nor AI are monoliths

Education of the Future
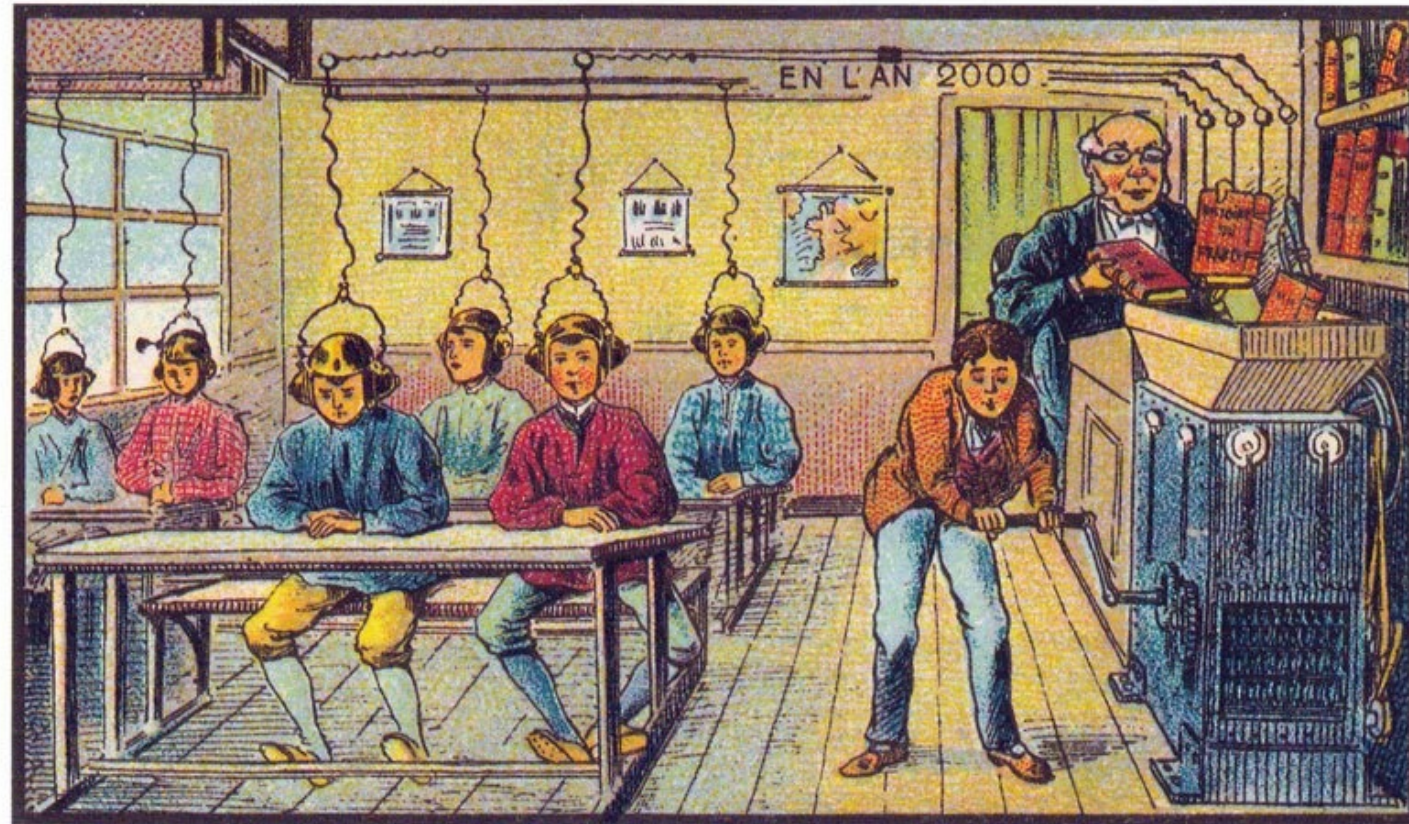
The persisting transmitter template
(Paulo Blikstein, AIED 2018 keynote)

The efficiency and measurability argument

- Rescuing teachers from repetitive and boring tasks

- Explaining

- Repeating time and again

- Breaking content into tiny pieces

The efficacy and effectiveness argument

- Learning is not about explanation, but about knowledge construction

- Learning is not about repetition, but about constant contextualised equilibration and negotiation between old and new theories

- Complex things may be easier to learn than simpler, atomic pieced of knowledge (Papert)

AIED: a challenge to the standard models of AI and Education

Challenging the standard model of AI (and of Education)

"Intelligence measures an agent's ability to achieve goals in a wide range of environments."
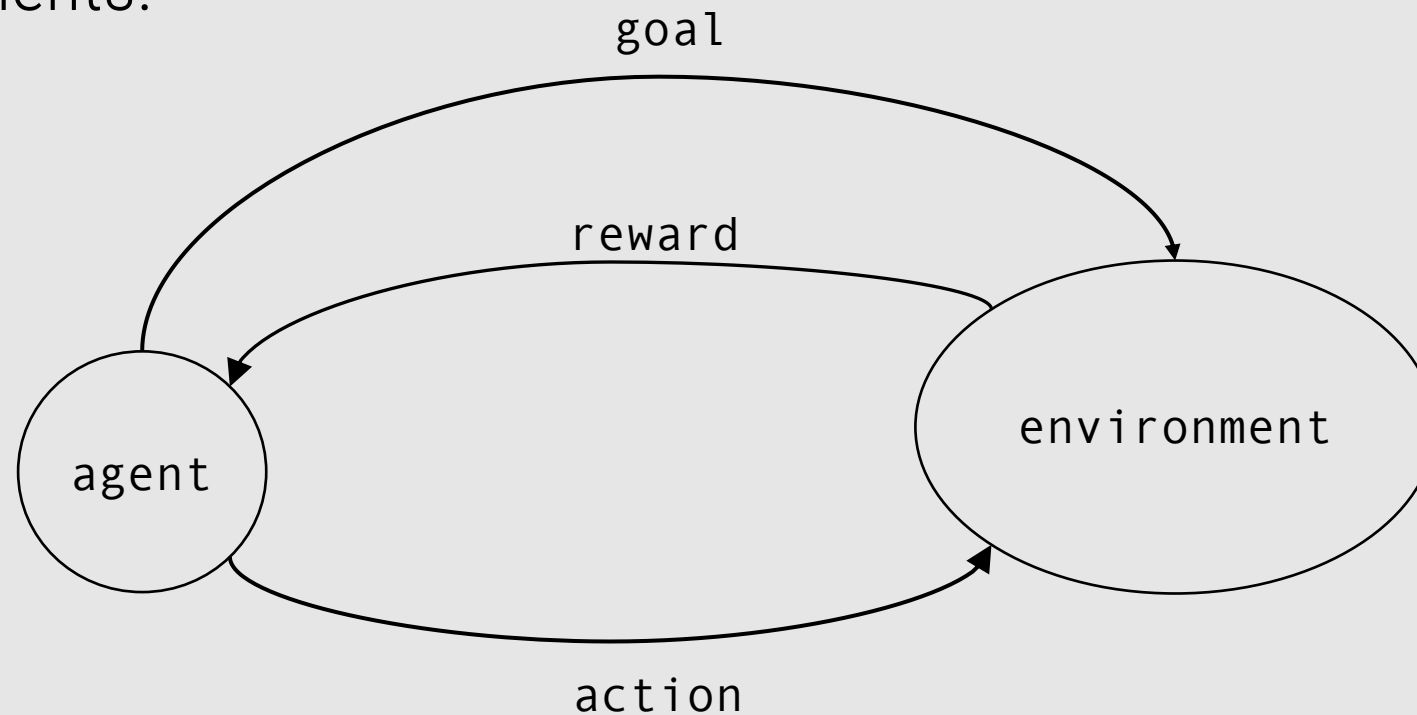
AIED is…

An interdisciplinary and applied field, with roots in computer science, education and social science whose goal is to create technology (software) that helps people learn better.

A field that draws aggressively from a large number of advanced computational techniques to build a wide variety of systems to help learners in authentic learning contexts.

A field that draws from from best ideas in social sciences and evaluates them (and their renditions through AIED systems) using tried and tested social science methods for human subject evaluation

McCalla (2023). Handbook of Artificial Intelligence in Education, p 10, Edward Elgar

Motivation for Intelligent Tutoring Systems

2 sigma effect (Bloom, 1984):

- 98% of students with a ***personal human tutor*** performed 2 standard deviations (2 σ) better than an an average classroom student
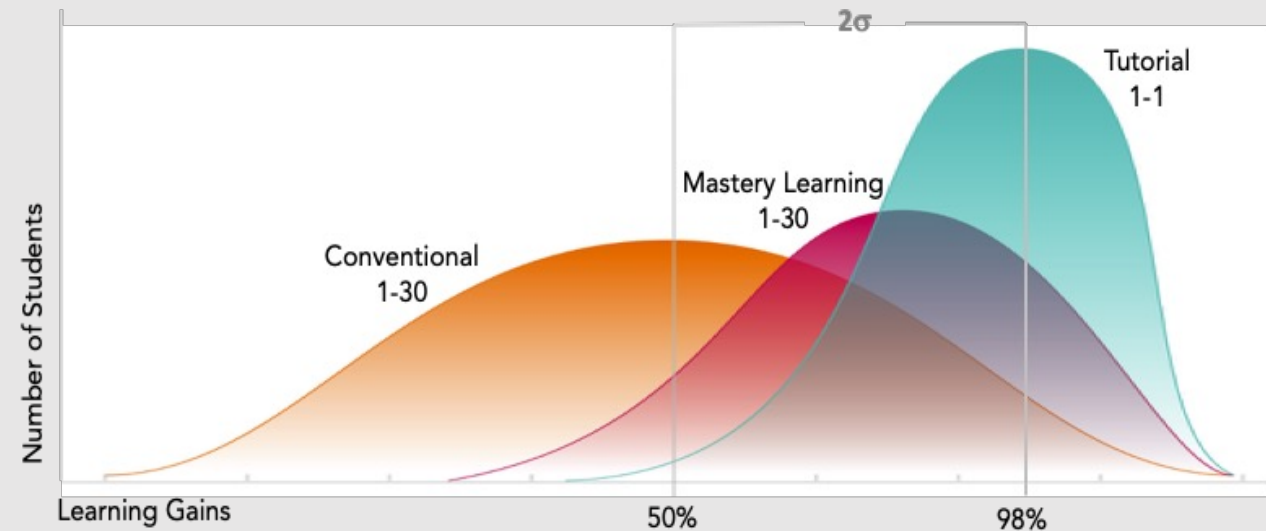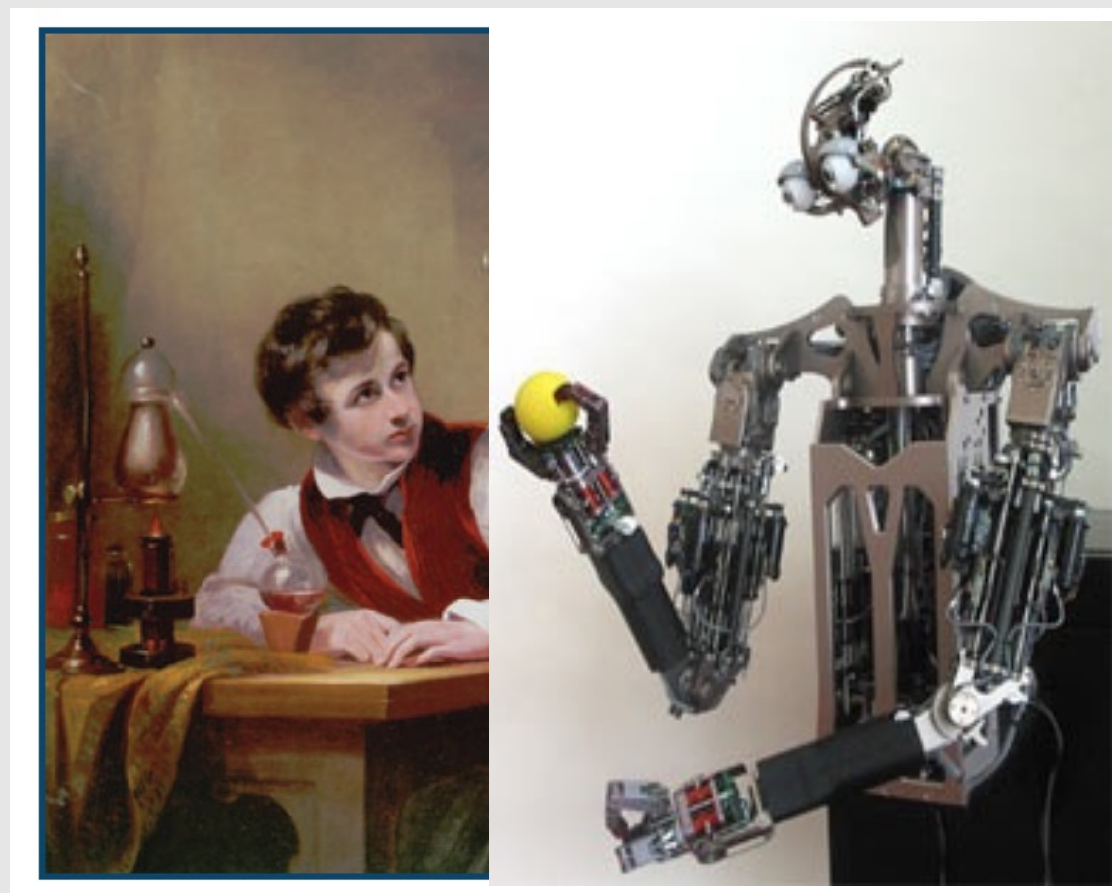
Bloom, B. (1984) "The 2 Sigma Problem: The Search for Methods of Group Instruction as Effective as One-to-One Tutoring." Educational Researcher 13 (6):4–16.

Scaling up one-to-one approach for all

Scaling up one-to-one approach for all

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McCalla (2023). Handbook of Artificial Intelligence in Education, p 10, Edward Elgar

Overarching AIED paradigm: Human in the loop

Best practice principles of learning:

- Active and situated construction of knowledge

- Metacognitive competencies

- Formative assessment and self-assessment

- Ethically grounded: diversity, inclusion, transparency, accountability, autonomy

Main AIED paradigms

- Didactic with constructivist feedback mechanism: help-seeking

  Cognitive Tutors (e.g. Aleven et al., Mavrikis et al.): mainly well-defined STEM domains

- Open-ended Learning Environments: learner as teacher

  Work at Vanderbilt (Biswas et al.)

- Exploratory Learning Environments: enquiry-led learning

  Many examples for both well- and ill-defined domains (e.g. social interaction and communication, e.g. Mavrikiset al; Porayska-Pomsta et al.)

- Open Learner Models: user data in the hands of the user

  Numerous examples across all of AIED, but best known the work by Bull and Kay

AI for exploratory learning

Main AIED paradigms

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AI for self-reflection

TARDIS provides opportunity for:

- Interactive rehearsal of skills with socially credible artificial agents

- Exploration of another agent's reactions in real-time

- Situated recall of interactions with fine grained social cues data

- Learners to inspect, explain or dispute their own interaction behaviours

- Practitioners to have at their disposal a tool for concrete and targeted conversation

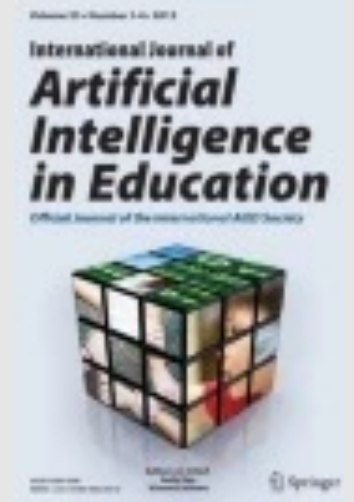# Overarching driving principles & evidence

Learning-need-driven

Context-need-driven

Best pedagogical practice-driven

Theory-, practice-, evidence-based
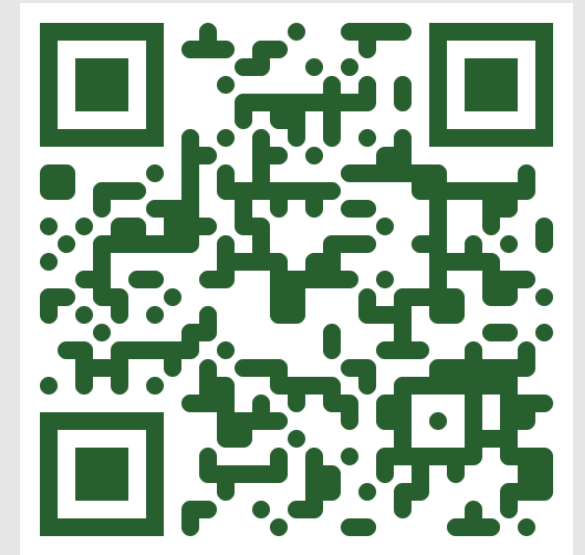
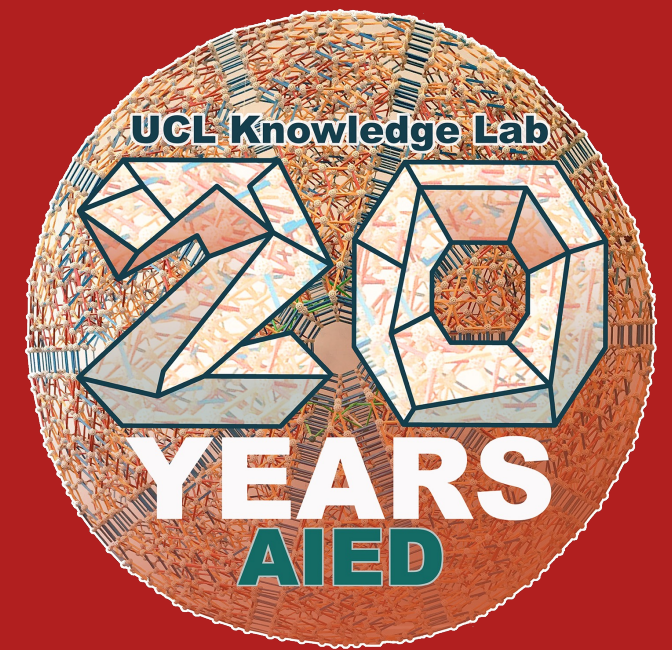design, evaluation and deployment of AI in Education

https://aied.org

Points for consideration

- Paradigms

- Incentives

- Values

- Competencies

Paper accompanying this talk

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Thank you!

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