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AI and Education:
Promise and Implications for Teaching and Learning

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UCL

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Lorsque vous entendez les mots
« Intelligence Artificielle »,
quelle est la première chose
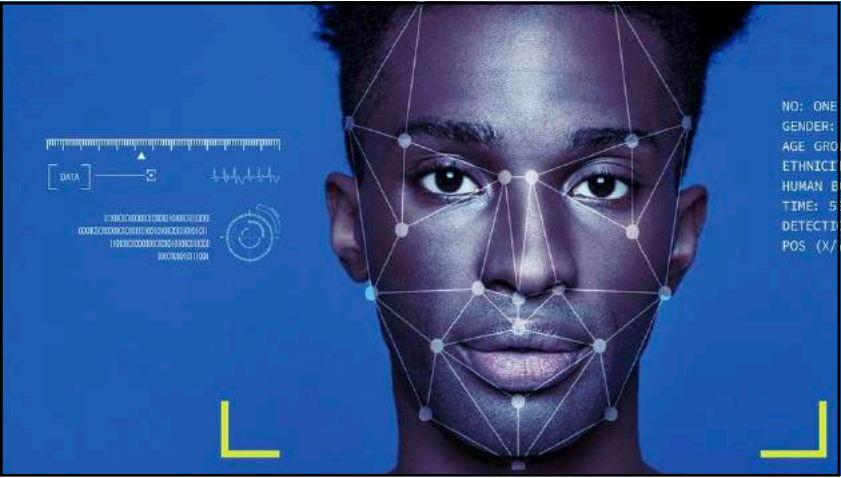qui vous vient à l'esprit ?
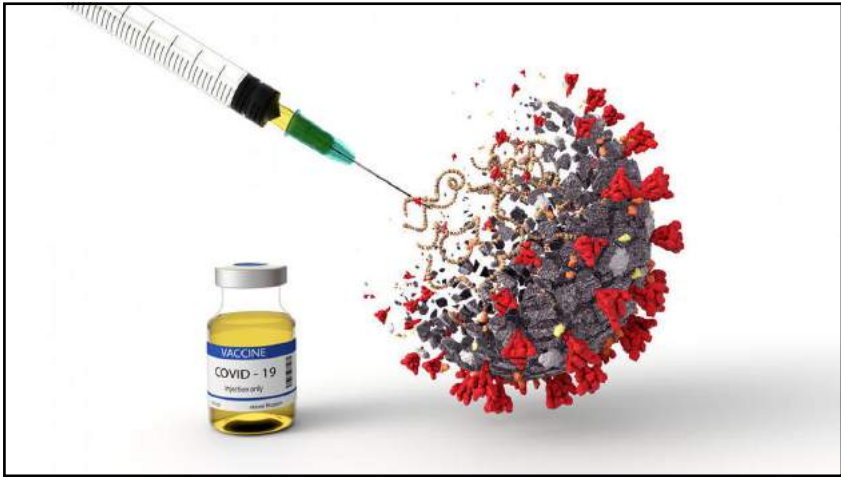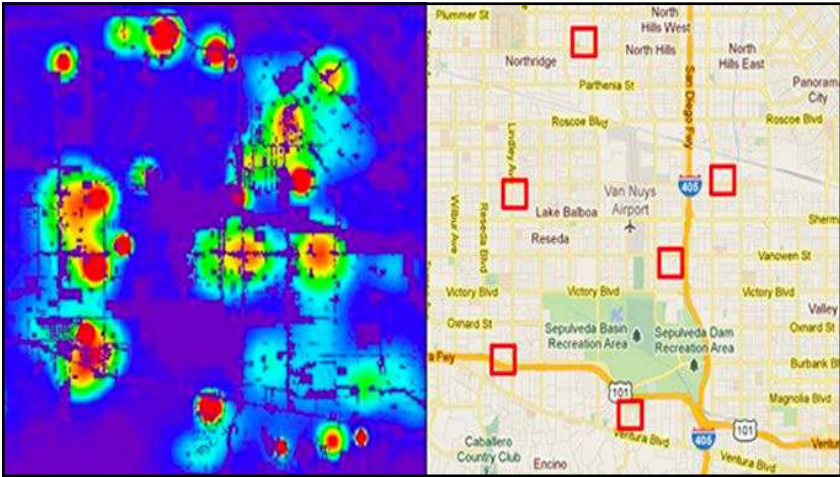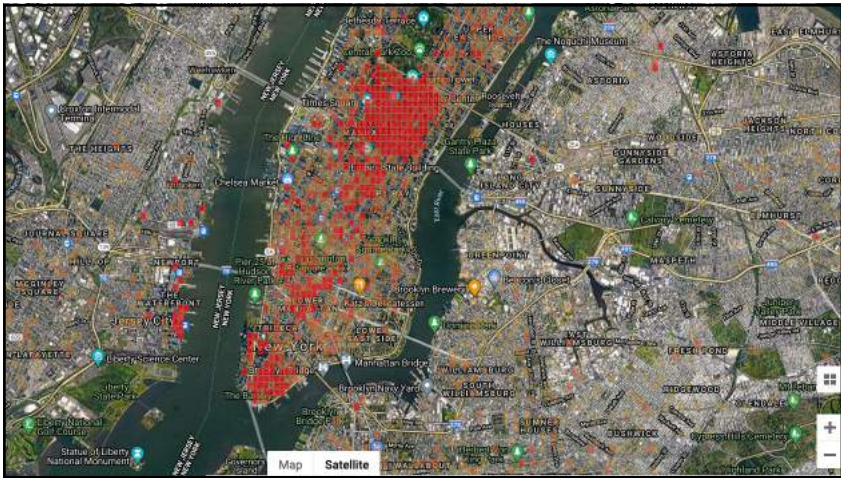
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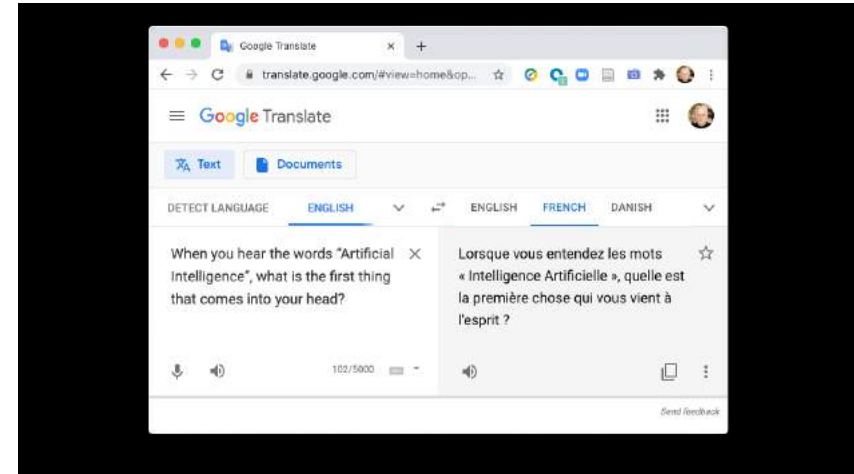19

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Artificial Intelligence (AI)

- AI is **already** here and can do some amazing things.
- AI **affects our daily lives** in many different ways.
- But we usually **don't recognise** it as AI.

  Instead, we call it computer games, or WhatsApp, or passport control, or self-driving cars, or proactive policing, or…

  …and robotics is only **one application** of AI.

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Artificial Intelligence and education

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AI and education: 3 buckets (categories)

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Artificial Intelligence and education

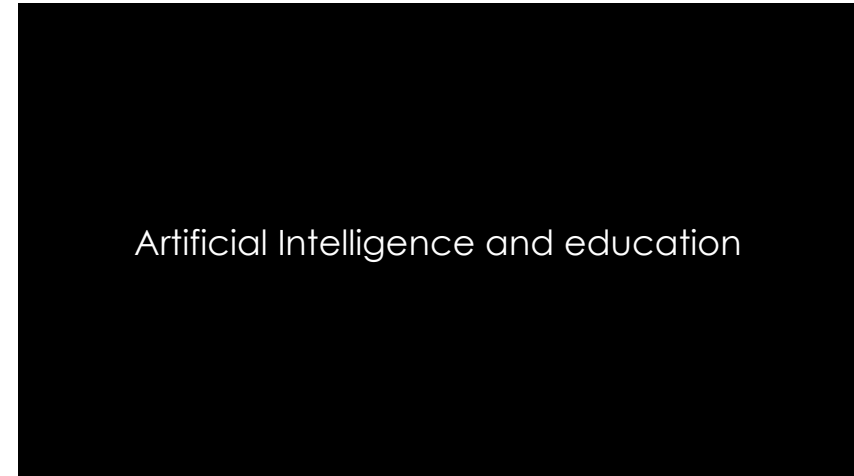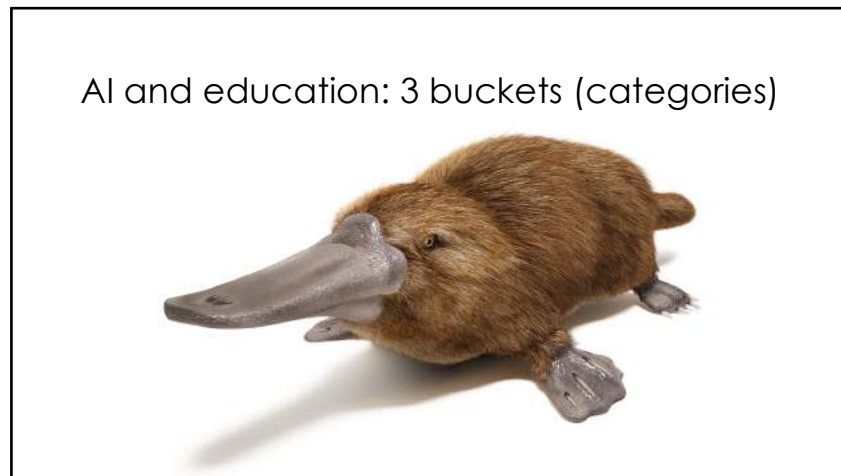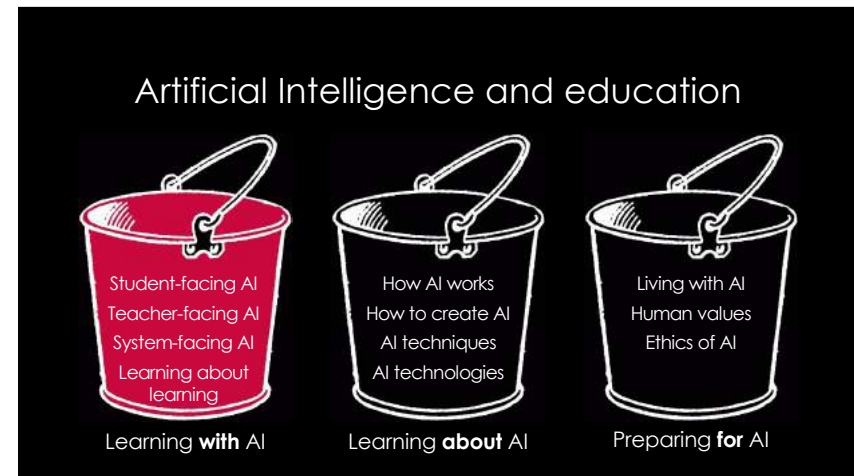| Learning **with** AI	Learning **about** AI	Preparing **for** AI
Student-facing AI Teacher-facing AI System-facing AI Learning about learning	How AI works How to create AI AI techniques AI technologies	Living with AI Human values Ethics of AI

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Learning **with** AI – **system** facing

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Learning **with** AI: **system**-facing

- AI technologies that automate aspects of **school** or **university administration**, including:
  - admissions,
  - timetabling,
  - learning management,
  - attendance recording,
  - predicting which students are at risk of failure…

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Learning **with** AI – **student** facing

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Learning **with** AI: **student**-facing

There are many different types.

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Learning **with** AI: **student**-facing

Intelligent Tutoring Systems (ITS)

- Alef
- ALEKS
- alta
- AmritaCREATE
- Area9
- Assistments
- Byjus
- Century
- Civitas
- CogBooks
- Cognii
- Domoscio
- Dreambox
- EnLearn
- Inq-ITS
- iReady
- Knewton
- Liulishuo (Laix)
- Mathia
- Qubena
- RealizeIt
- Smart Learning Partner
- Querium
- Riiid
- Smart Sparrow
- Snappet
- Soffos
- Squirrel AI
- Summit Learning
- Thinkster Math
- Toppr

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Learning **with** AI: **student**-facing

Dialogue-based Tutoring Systems
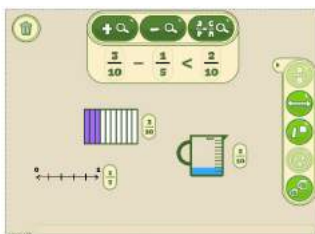

- AutoTutor
- CIRCSIM
- SCHOLAR
- Watson Tutor

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Learning **with** AI: **student**-facing

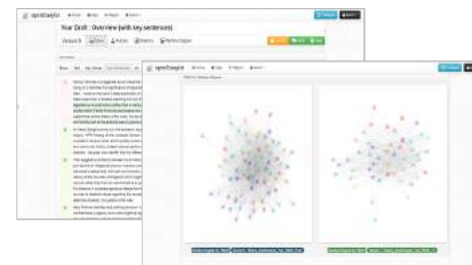### Exploratory Learning Environments

- Betty's Brain
- Crystal Island
- ECHOES
- Fractions Lab

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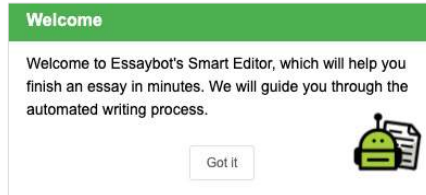## Learning **with** AI: **student**-facing

Automatic Writing Evaluation

- e-Rater
- Intelligent Essay Assessor
- OpenEssayist
- PEG
- Revision Assistant
- Write to Learn

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Learning **with** AI: **student**-facing

Automatic Essay Writing

- AI Writer
- Articoolo
- Conversion.ai
- Essay Toolbox
- Essaybot
- Marlowe
- MyEssayBot
- Sassbook
- WordAi
- …

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Learning **with** AI: **student**-facing

Learning Network Orchestrators

- Smart Learning Partner
- Third Space Learning

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Learning **with** AI: **student**-facing

Language Learning

- TAL AI Language Teaching System
- Babbel
- Duolingo
- Enskill (Alelo)
- Lingvist
- LAIX
- IEnglish
  …and many others

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Learning **with** AI: **student**-facing

ITS +

Lumilo

- ALP
- Alt School
- Lumilo
- Cognitive and Immersive Systems Lab

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Learning **with** AI: **student**-facing

Chatbots

- ADA
- Genie
- EduBot
- LaMDA
- (Woebot – for mental health)
  …and many others

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Learning **with** AI: **student**-facing

Smart curation of learning materials

- X5GON

X5GON Discovery
Search and find materials from all over the world

Search for OER Material

Suggested queries: Machine Learning / Deep Learning / Support Vector Machine / Climate Change

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Learning **with** AI – **teacher** facing

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Learning **with** AI: **teacher**-facing
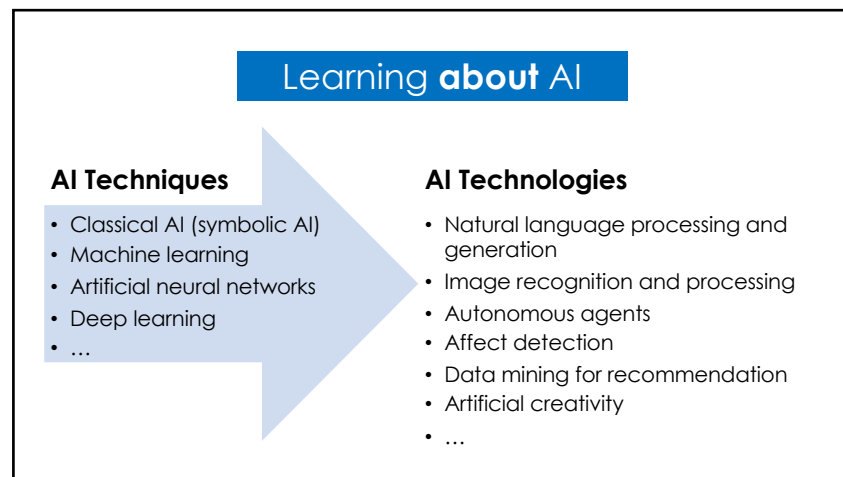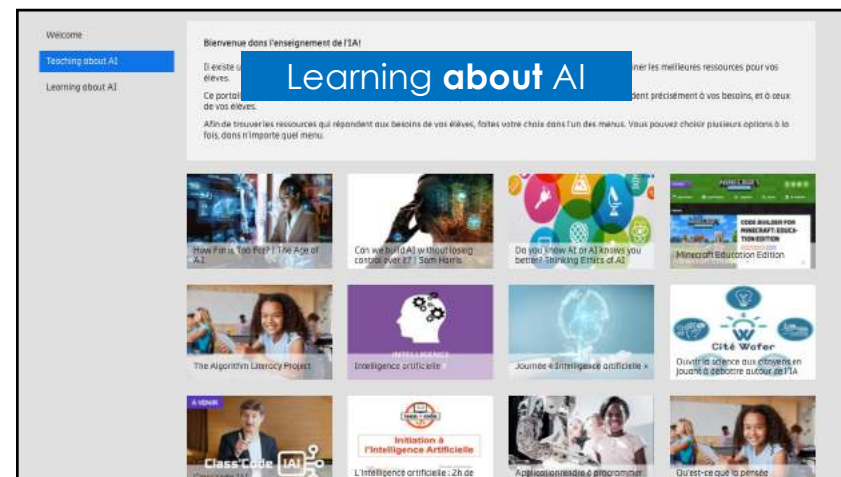
Student-facing AI + dashboard

$$\neq$$

Teacher-facing AI

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Learning **with** AI: **teacher**-facing

Teacher Advisor

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Artificial Intelligence and education

Student-facing AI
Teacher-facing AI
System-facing AI
Learning about learning

Learning **with** AI

How AI works
How to create AI
Applications of AI

Learning **about** AI

Living with AI
Human values
Ethics

Preparing **for** AI

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Learning **about** AI

AI Techniques

- Classical AI (symbolic AI)
- Machine learning
- Artificial neural networks
- Deep learning
- …

AI Technologies

- Natural language processing and generation
- Image recognition and processing
- Autonomous agents
- Affect detection
- Data mining for recommendation
- Artificial creativity
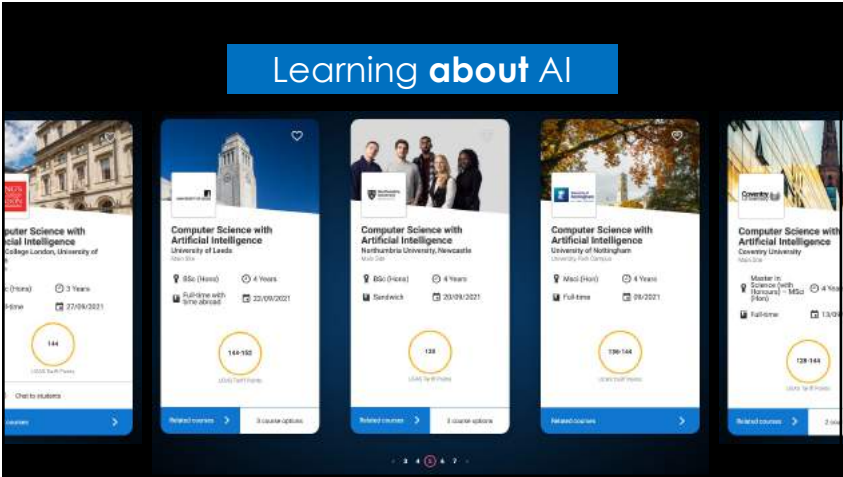- …

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Learning **about** AI
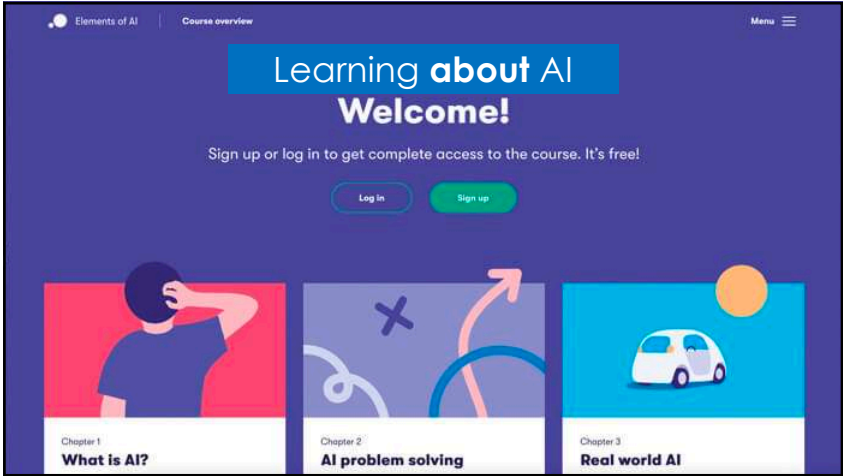

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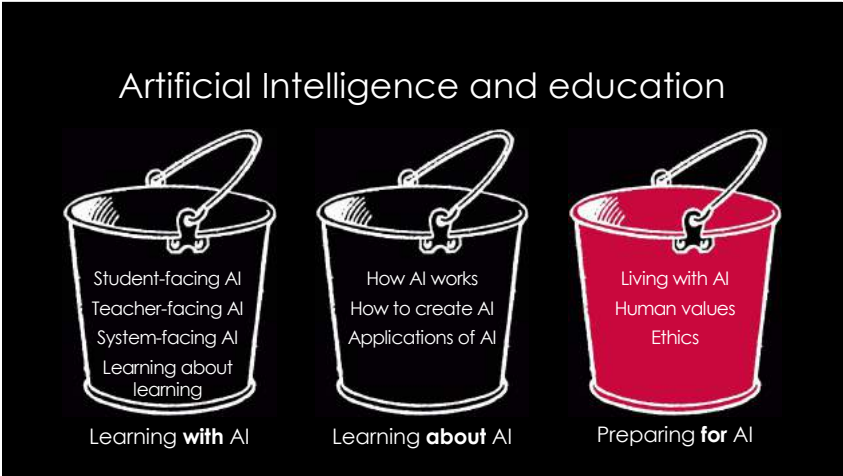

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Preparing **for** AI

?

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Preparing **for** AI

A research institute examining the social implications of artificial intelligence

NEW YORK UNIVERSITY

The AI Now Institute at New York University is an interdisciplinary research center dedicated to understanding the social implications of artificial intelligence.

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Limits of Artificial Intelligence

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Limits of AI

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Limits of AI

- A human chooses and cleans the data.
- A human labels the data.
- A human designs the network.
- A human trains the network.
- A human curates the outputs and makes the value judgements.

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Limits of AI

Panda
57.7% confidence

Gibbon
99.3% confidence

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Limits of AI

Tay	BabyQ	Rinna	Luda
(USA)	(China)	(Japan)	(Korea)
Racist and sexist comments	Online defamation	Professed a love for Adolf Hitler	Offensive comments about disability and homosexuality

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Limits of AI

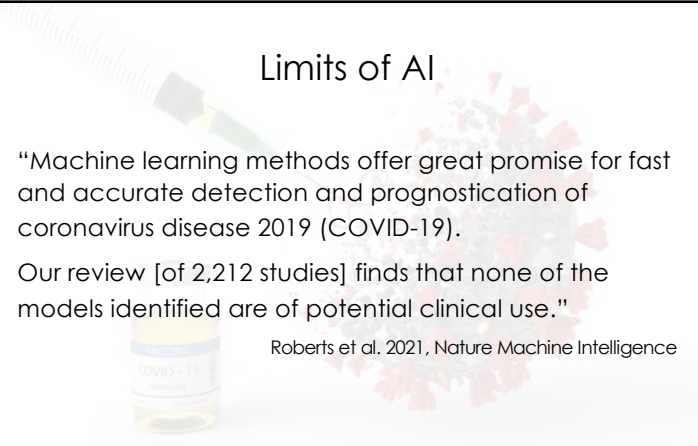| Lighter skin males	Darker skin males	Lighter skin females	Darker skin females
100%	98.7%	92.9%	68.6%

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Limits of AI

"Machine learning methods offer great promise for fast and accurate detection and prognostication of coronavirus disease 2019 (COVID-19).

Our review [of 2,212 studies] finds that none of the models identified are of potential clinical use."

Roberts et al. 2021, Nature Machine Intelligence

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The ethics of
Artificial Intelligence and education

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The ethics of AI and education

Data

What data is collected
(is the data private, consent given?)
What proxies are being used/misused?
How is the data analysed
(there's no such thing as raw data)?
What are the implications?

Holmes et al. (2021) *Ethics of AI in Education: Towards a Community-Wide Framework*. International Journal of AI in Education
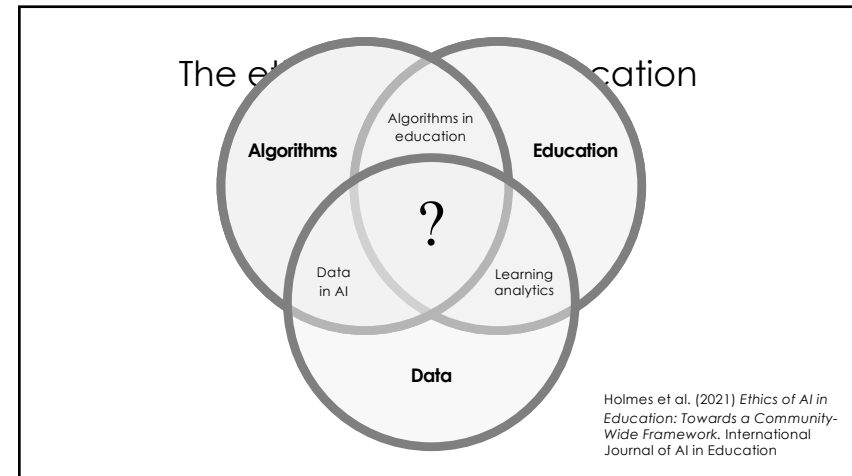
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The ethics of AI and education

Algorithms

How do we prevent algorithmic biases?
How do we guard against mistakes?
How do we protect against
unintended consequences?
How do we stay in control?

Holmes et al. (2021) *Ethics of AI in Education: Towards a Community-Wide Framework*. International Journal of AI in Education

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The ethics of AI in education

Education

Self-fulfilling teacher expectations?
Unsustainable techno-solutions?
Gender and ethnic biases?
De-professionalising teachers?
Accuracy and validity
of assessments?
Student agency?

Holmes et al. (2021) *Ethics of AI in Education: Towards a Community-Wide Framework.* International Journal of AI in Education

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The ethics of AI in education

Algorithms

Algorithms in education

Education

?

Data in AI

Learning analytics

Data

Holmes et al. (2021) *Ethics of AI in Education: Towards a Community-Wide Framework.* International Journal of AI in Education

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Replacing or augmenting teachers?

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Slide 68

Replacing or augmenting teachers?

facebook

"Unfortunately we didn't have a good experience using the program, which requires hours of classroom time sitting in front of computers... The assignments are boring, and students feel as if they are not learning anything.... It's severely damaged our education, and that's why we walked out in protest."

Washington Post newspaper, November 2018

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Replacing or augmenting teachers?

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Classroom monitoring

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Classroom monitoring

"I don't dare be distracted after the cameras were installed in the classrooms. It's like a pair of mystery eyes are constantly watching me."

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Classroom monitoring

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Exam monitoring

Proctoring software:
- Uses the computer's camera, microphone and web browser to record test-takers
- Often requires a room scan to ensure the student is alone
- Validates identity using biometric measures like facial recognition or keystroke analysis
- Doesn't allow test-takers to leave the view of the camera, or to look away from the screen too many times or for too long.
- Uses AI to automate the monitoring.

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University monitoring

These systems represent a new low in intrusive technology, breaching students' privacy on a massive scale. The tracking systems will infantilize students, further training them to see surveillance as a normal part of living, whether they like it or not."

(Stokel-Walker, 2020)

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Automated assessment

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Automated essay grading

Fooled by gibberish and highly susceptible to human bias, automated essay-scoring systems are being increasingly adopted

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Automated essay grading

*"**Computers cannot measure the essentials of effective written communication**: accuracy, reasoning, adequacy of evidence, good sense, ethical stance, convincing argument, meaningful organization, clarity, and veracity, among others.*

Professionals Against Machine Scoring Of Student Essays In High-Stakes Assessment.
http://humanreaders.org

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Automated continuous assessment

Replacing examinations:

- *'Stop and test' assessments do not rigorously evaluate a student's understanding of a topic.*
- *"Artificial intelligence-based assessment provides constant feedback to teachers, students and parents about how the student learns, the support they need and the progress they are making towards their learning goals."*

(Luckin, 2017)
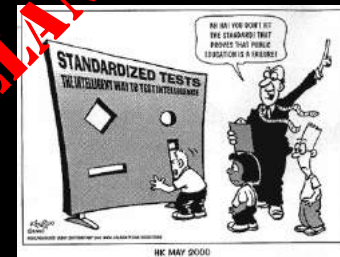
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The ethics of AI and education

- Do no harm.
- Doing things ethically vs. doing things that are ethical.
- Transparency.
- Avoiding bias.
- Unintended consequences.
- Autonomy.
- Student agency.
- Surveillance
- Addressing diversity.

- Opening up the black box.
- Misuse of personal information.
- Earning and maintaining trust.
- Equity of access.
- Implications of predictions.
- Back-door privatisation.
- Sharing information.
- Student agency
- Marginalization of vulnerable populations.

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The ethics of AI and education

	+ve	-ve
Automatic writing evaluation	Automatic formative assessment	Inaccurate summative assessment
Intelligent Tutoring Systems	Personalised learning (in limited domains)	Limited student agency. Lack of human interaction.
Campus monitoring	Monitoring student well-being	Continuous surveillance
Emotion detection	Move students from -ve to +ve emotions to enhance learning	Compromised privacy (the final frontier?)
Continuous assessment	No more exams	Continuous surveillance

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In summary…

- AI is clever but not as clever as many people claim.
- AI is likely to have a major impact in education.
- AI has the potential to transform education – for good, but also for bad.
- Educators, learning scientists and policymakers must engage with computer scientists and AI developers, to ensure that AI and education meets real needs and addresses the common good.
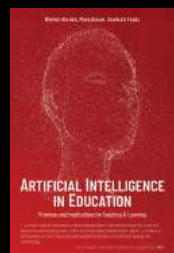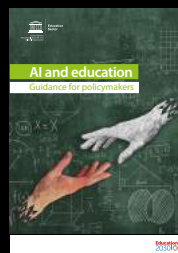
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Further reading…

Intelligence Unleashed.
An Argument for AI in Education.

Technology-enhanced Personalised Learning.
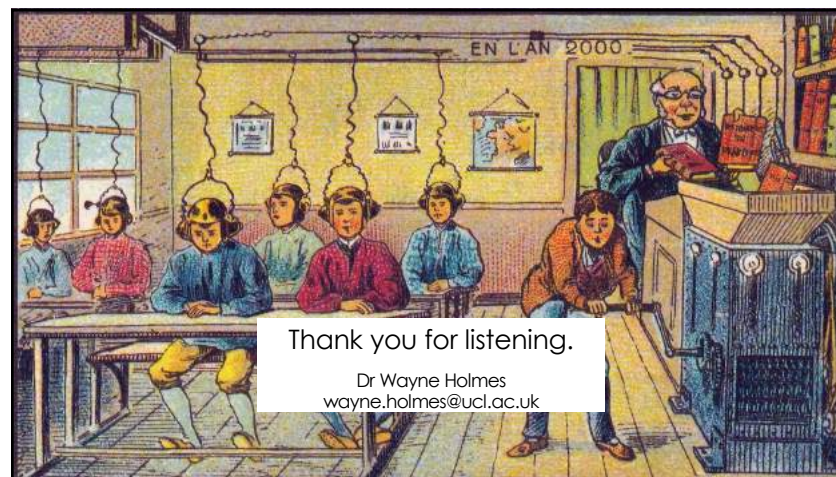Untangling the Evidence.

Artificial Intelligence in Education.
Promises and Implications for Teaching and Learning.

AI and Education.
Guidance for Policymakers.

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Thank you for listening.
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wayne.holmes@ucl.ac.uk

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