Professor
Rose Luckin

Empowering Students and Teachers for a Future Transformed by AI

Artificial intelligence in Education

1

AI tools:

Using AI in Education to tackle some of the big educational challenges

2

Increasing our Human Intelligence:

Changing Education so that we focus on human intelligence and prepare people for an AI world

3

Learning about AI:

Educating People about AI so that they can use it safely and effectively

EDUCATE VENTURES RESEARCH

But first..
What is Artificial Intelligence (AI)?

EDUCATE
VENTURES RESEARCH

EDUCATE
VENTURES RESEARCH

EC High-Level Expert Group on Artificial Intelligence definition within the European Commission's Communication on AI

https://ec.europa.eu/futurium/en/system/files/ged/ai_hleg_definition_of_ai_18_december_1.pdf

"Artificial intelligence (AI) refers to systems that display intelligent behaviour by analysing their environment and taking actions – with some degree of autonomy – to achieve specific goals.

AI-based systems can be purely software-based, acting in the virtual world (e.g. voice assistants, image analysis software, search engines, speech and face recognition systems) or AI can be embedded in hardware devices (e.g. advanced robots, autonomous cars, drones or Internet of Things applications)."

And AI is not new!
And, AI in
Education is not
New

EDUCATE
VENTURES RESEARCH

EDUCATE
VENTURES RESEARCH

But freely available AI is new

Claude

Good evening, Rose

What can I help you with?

Start Chat

New in Claude

Understand and work with images

Convert UI design to front-end code

Extract text from images

Suggest product descriptions

Previous chats from today

Hello, Rose

How can I help you today?

Help me write HTML, CSS, and JS

```
<!DOCTYPE html>
<html>
<head>
<title>Image Slider</title>
<link rel="stylesheet"
href="style.css">
```

Role-play as a character from a novel

Goodness, what a delightful day! The sun fairly beams upon us - I should say it's an exceptional day for a walk in the countryside, wouldn't you agree? Though I'm not certain what sort of weather you are enjoying

Inspire me from an image

Image Analysis: I can identify the objects, people, and places in the image, as well as the overall scene and activity. For example, I can tell that the image shows a group of people sitting around a table in a

Create a CSS color palette from an image

```
:root {
forest-green: #228B22;
bark-brown:  #663300;
warm-sand: #F5DEB3;
sky-blue:  #ADD8E6;
stone-gray:  #778899;
```

Your conversations are processed by human reviewers to improve the technologies powering Gemini Apps. Don't enter anything you wouldn't want reviewed or used.

How it works Dismiss

DALL·E 2 Credit Sales Ending May 1st

Labs credits will be available for purchase until May 1, 2024. Credits are valid for one year from the purchase date.

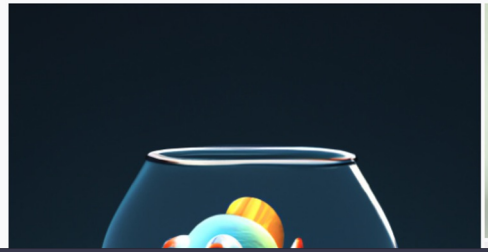
As a thank you, we'll be granting you 15 Labs credits every month from April 1, 2024, to April 1, 2025. These credits will expire after 30 days.

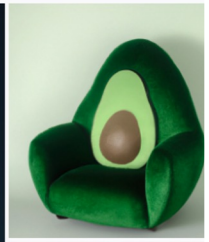
If you haven't yet, try DALL·E 3, which is available for ChatGPT Plus, Team and Enterprise users and through the OpenAI API.

Start with a detailed description **Surprise me**

An Impressionist oil painting of sunflowers in a purple vase...

Or, **upload an image** to edi





How can I help you today?

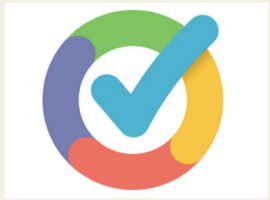
Suggest fun activities
to help me make friends in a new city

Give me ideas
for what to do with my kids' art

Plan a trip
to explore the nightlife scene in Bangkok

Write a Python script
to automate sending daily email reports

Message ChatGPT...

Quill

OpenAI

Brisk Teaching

sibme


gradescope
by Turnitin

MAGiC
SCHOOL

TeachMateAI

Class Companion

FeedbackFruits


nTask.

TeachFX

UTS
UTS:CIC
CONNECTED INTELLIGENCE CENTRE
AcaWriter


Canva
K!

Auto
Classmate

Otter.ai

Artificial intelligence in Education

1

AI tools:

Using AI in Education to tackle some of the big educational challenges

2

Increasing our Human Intelligence:

Changing Education so that we focus on human intelligence and prepare people for an AI world

3

Learning about AI:

Educating People about AI so that they can use it safely and effectively

EDUCATE VENTURES RESEARCH

1

AI tools:

Using AI in Education to tackle some of the big educational challenges

2

Increasing our Human Intelligence:

Changing Education so that we focus on human intelligence and prepare people for an AI world

3

Learning about AI:

Educating People about AI so that they can use it safely and effectively

Artificial intelligence in Education

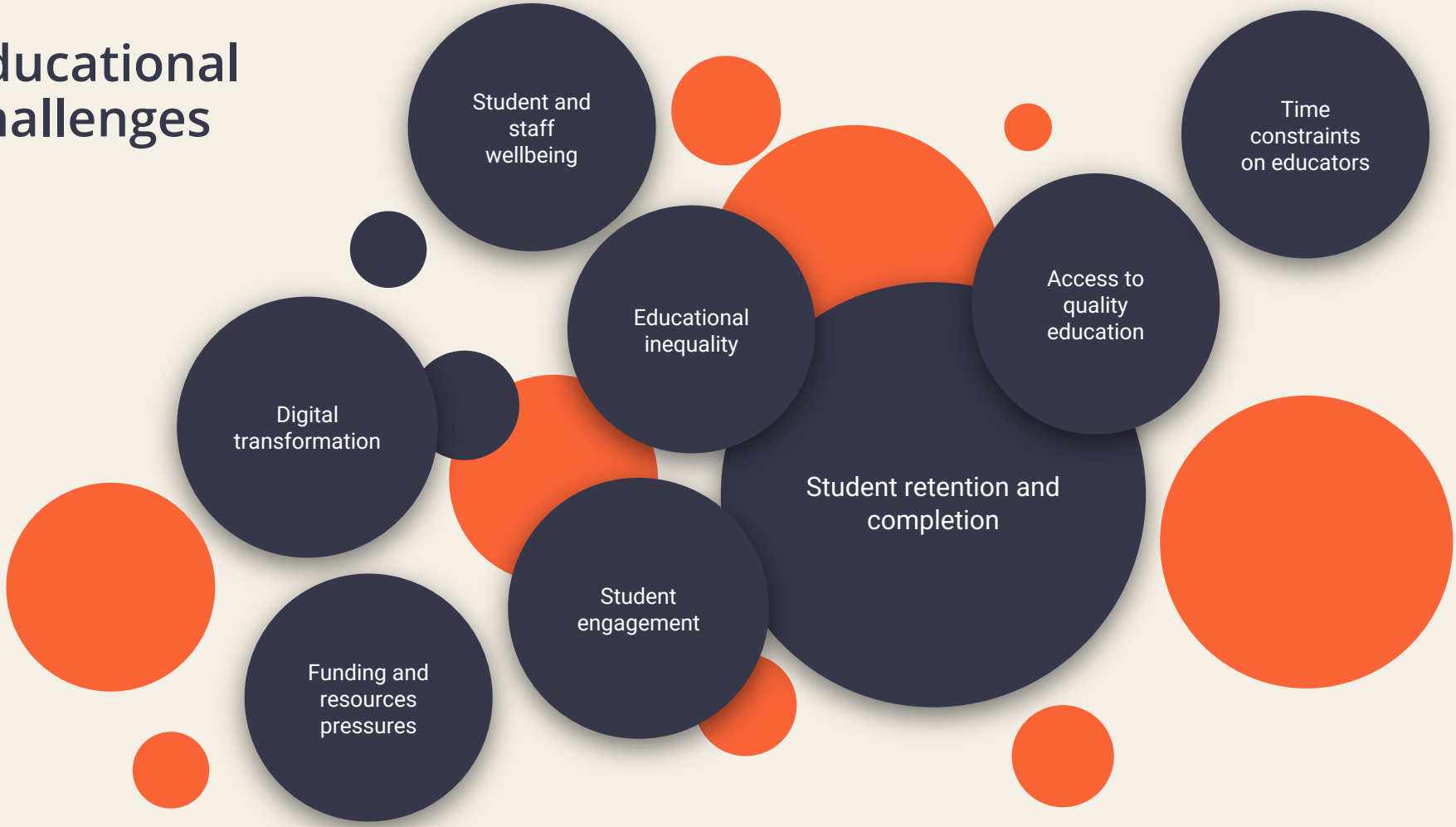
EDUCATE

VENTURES RESEARCH

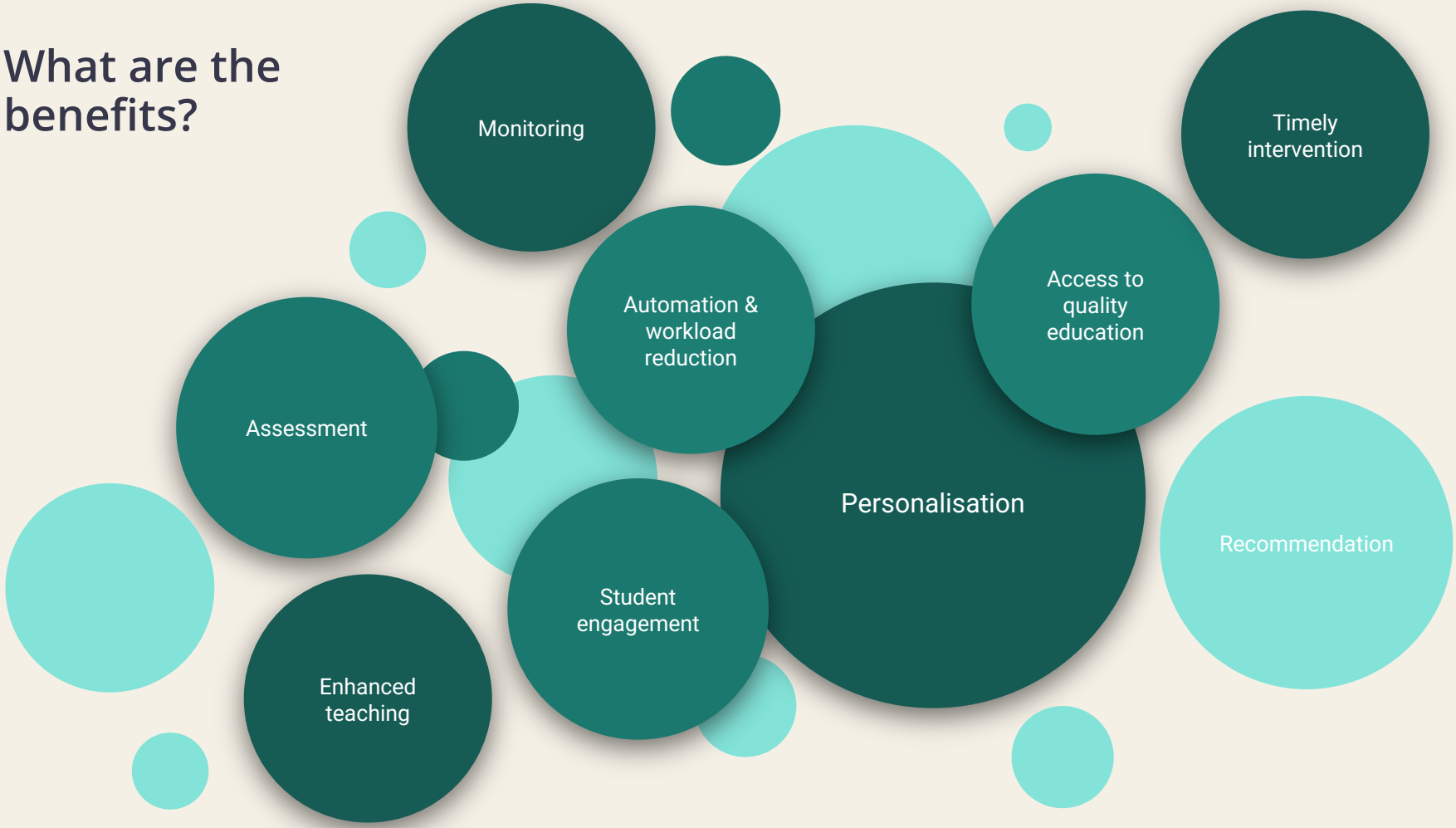
AI tools

Using AI in Education to tackle some of the big educational challenges

Educational challenges



What are the benefits?



Examples of AI use-cases

	Teacher admin	Lesson planning and enrichment	Lesson delivery	Student assessments	Teacher professional development and feedback
Potential AI use-cases	Streamlining administrative processes to boost productivity	Generate lessons in a range of topics, enrich lessons and boost productivity	Support teachers in lesson delivery through monitoring classroom interactions	Automate assessments, diagnose gaps in learning and recommend tailored interventions	Evidence teacher skills and support mentor-teacher interactions. Identify areas for improvement
Examples of tools	TeachMateAI	MAGIC SCHOOL	TeachFX	Class Companion	sibme
		Canva			Auto Classmate

AI as an analytical tool

To help us understand what is happening

Arizona State University

Mind the Gap: From Typical LMS Traces to Learning to Learn Journeys

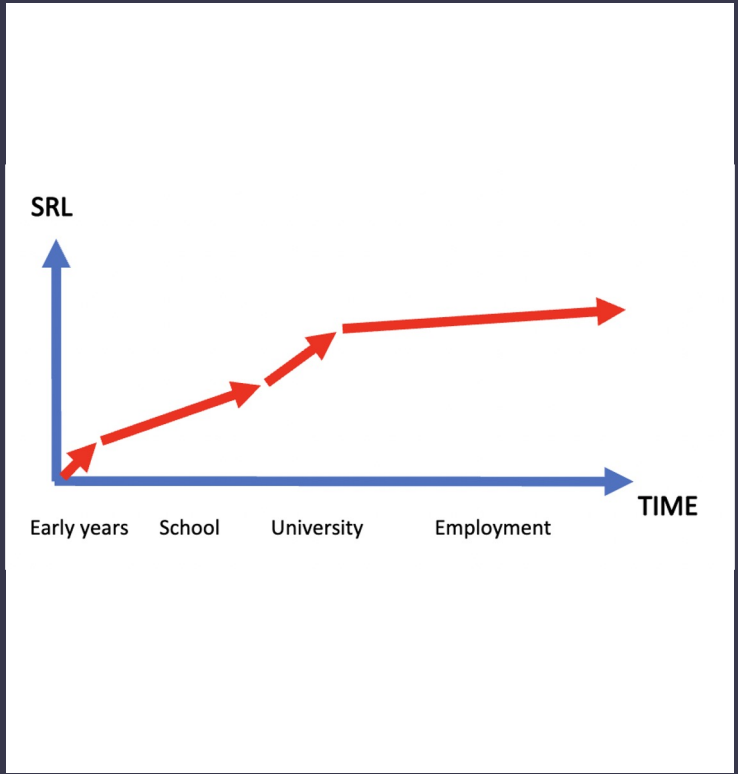
(2022). Mind the Gap: From Typical LMS Traces to Learning to Learn Journeys. In: Trajkovski, Goran; Demeter, Marylee and Hayes, Heather eds. Applying Data Science and Learning Analytics Throughout a Learner's Lifespan. IGI Global, pp. 1–26.

We helped Arizona State University to study student *behaviour patterns* to better understand which students were better at “Learning to Learn” and why, by *developing an ontology* that collated data signal about students’ self-regulated learning capability.

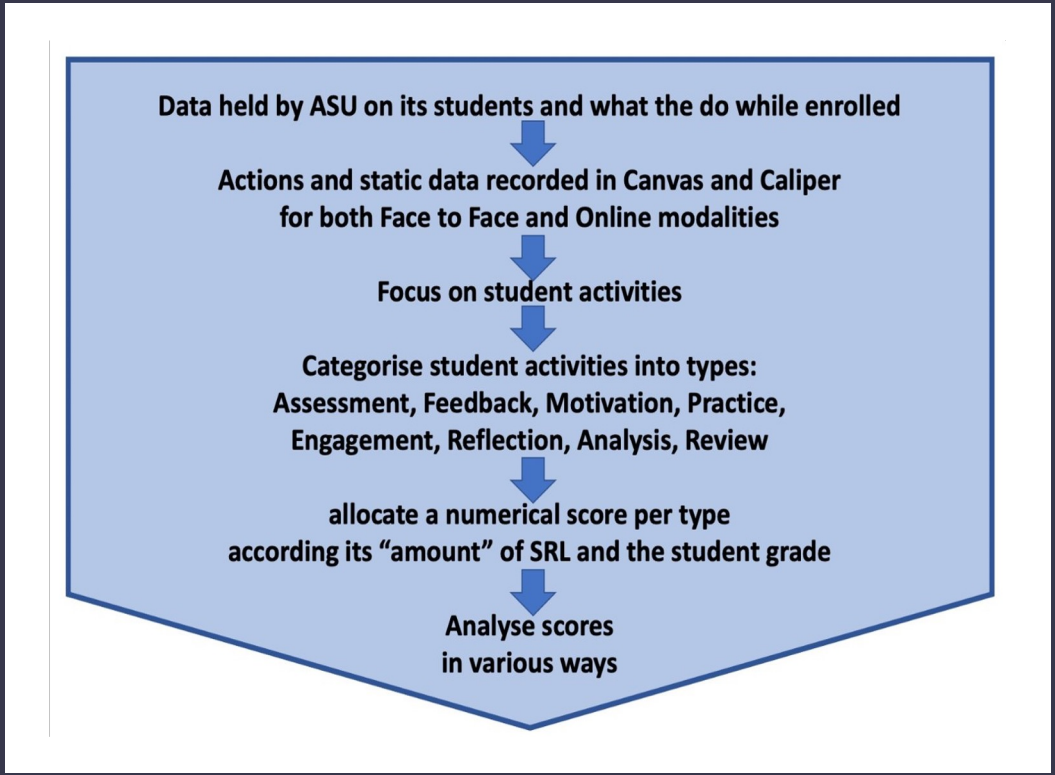
LTL

Learning to Learn is complex

- Learners' *understanding* of their own learning
- Learners' *ability to regulate* and manage their learning
- Learners' *ability to transfer* their learning skills to new areas



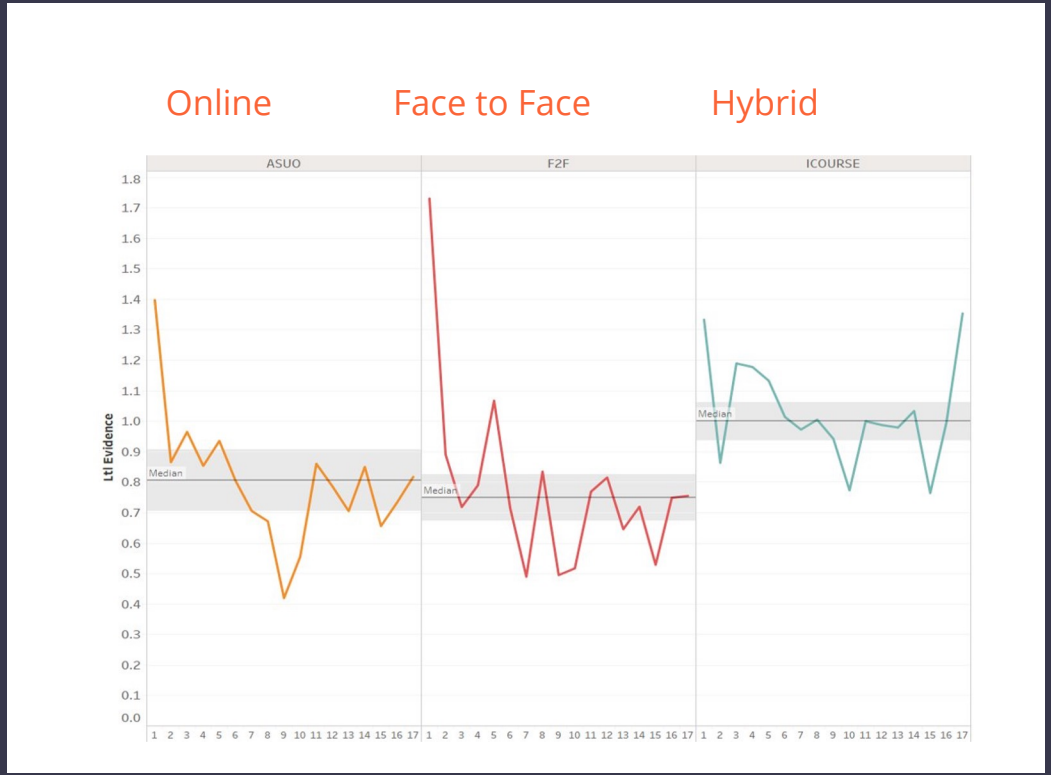
The data funnel



Findings

Different modalities

- *LTL* can be treated as a *dimension in its own right*
- Little difference between in-person and online, but hybrid program performed better
- LTL has a *temporal component*, it changes as the students progress through a term.

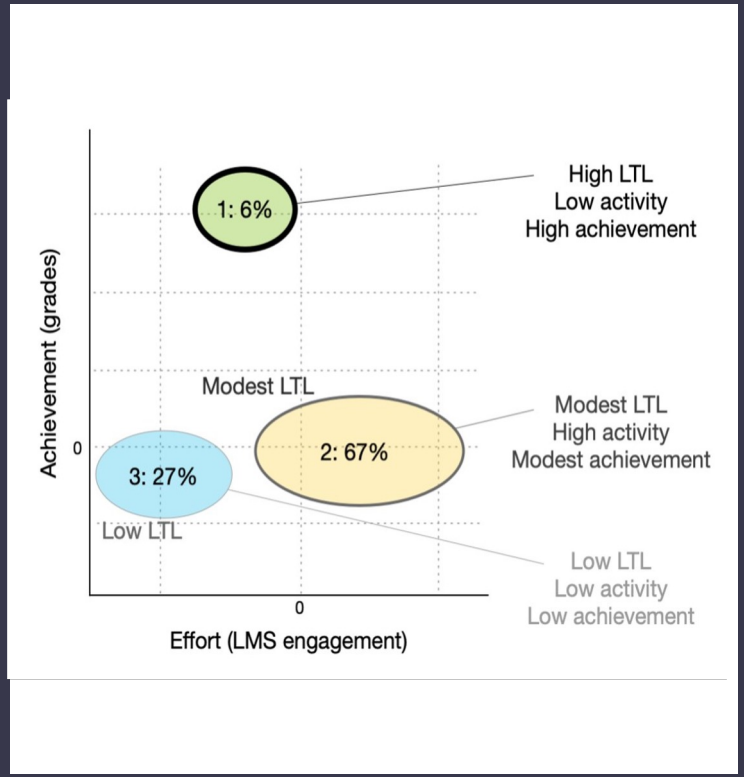


Findings

We identified *different student profiles.* Cluster analysis revealed 3 primary clusters:

- Efficient Achievers
- High-Activity
- Disengaged

The behaviour is different for each profile.

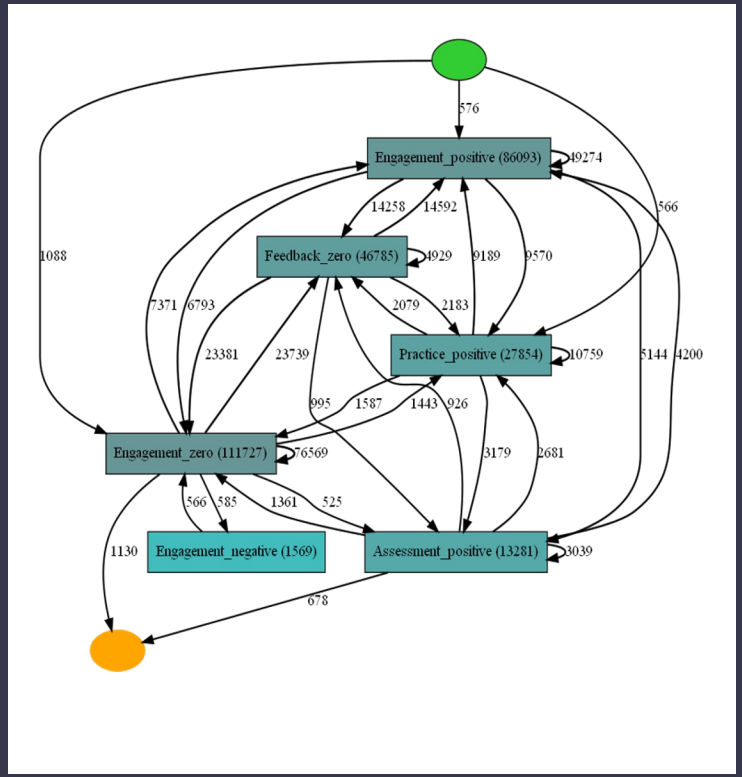


Findings

We *identified and compared* common *patterns of behaviour* in the different profile groups using *process mining*.

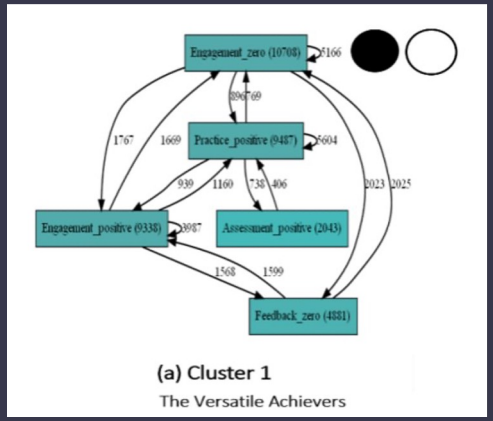
Example: Cluster 2

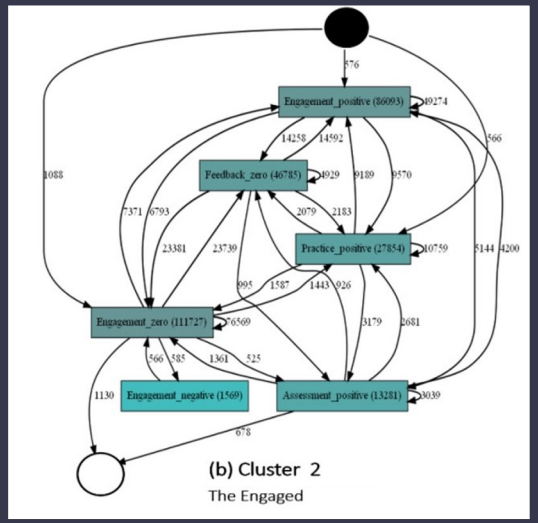
- Higher engagement than Cluster 1
- More positive practice instances than Cluster 1
- But their grades did not reflect their efforts

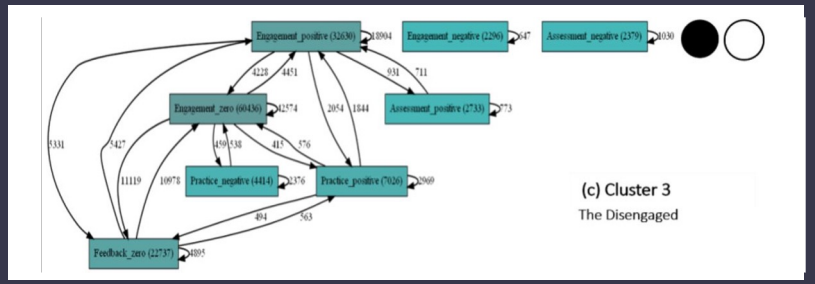


Findings

We compared common patterns of behaviour across different profile groups.







Artificial intelligence in Education

1

AI tools:

Using AI in Education to tackle some of the big educational challenges

2

Increasing our Human Intelligence:

Changing Education so that we focus on human intelligence and prepare people for an AI world

3

Learning about AI:

Educating People about AI so that they can use it safely and effectively

EDUCATE VENTURES RESEARCH

Increasing Human Intelligence

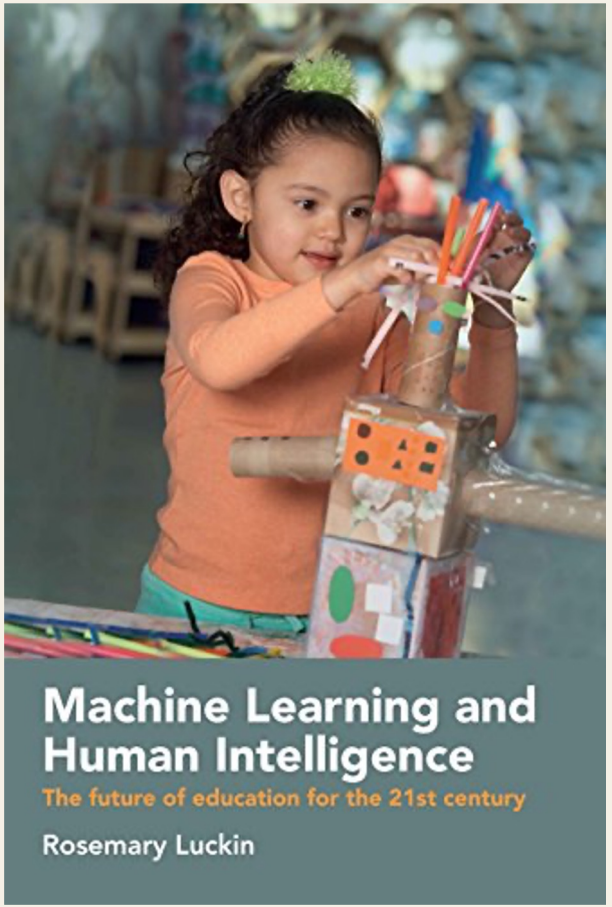
Changing Education so that we focus on human intelligence and prepare people for an AI world

EDUCATE
VENTURES RESEARCH

Learning is Complex

Our ability to learn must continue to evolve to be ever more sophisticated

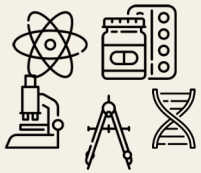
https://www.educateventures.com/_files/ugd/c43582_3950bb11755d4306ba9dc33811bbfc25.pdf



EDUCATE
VENTURES RESEARCH

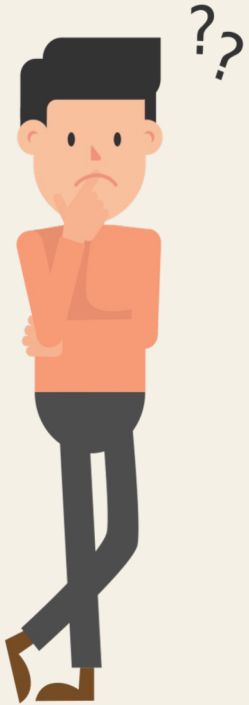
3. Social intelligence

2. Meta-knowing intelligence



1. Interdisciplinary Academic intelligence

4. Meta-cognitive intelligence

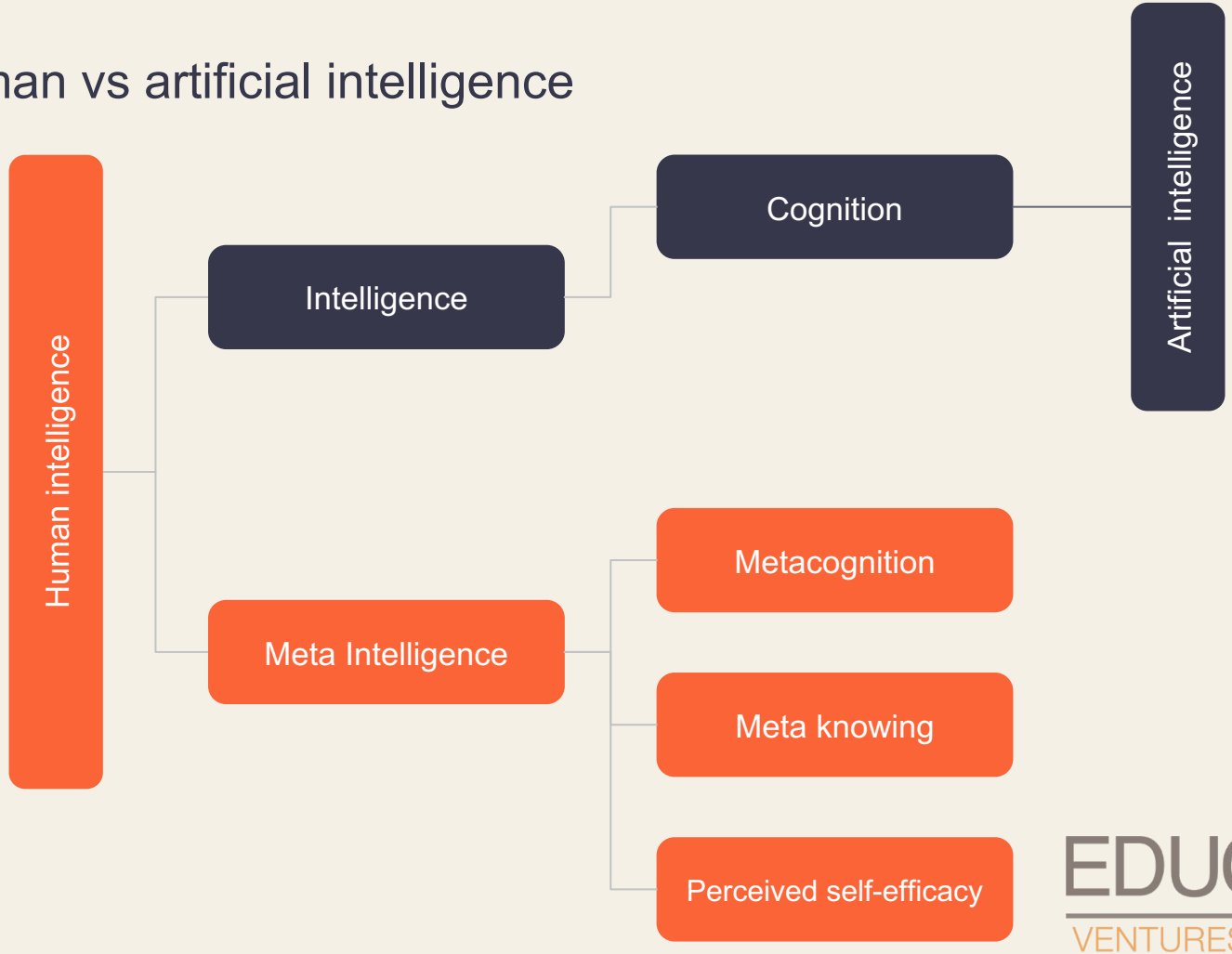


5. Meta-subjective intelligence

6. Meta-contextual intelligence

7. Perceived self-efficacy

Human vs artificial intelligence



EDUCATE
VENTURES RESEARCH

Caution

“Unlike most non-human biological cognition, human cognition is changing: the average IQ in many countries is increasing (the Flynn effect), **our memory** (Sparrow et al. 2011) **is changing** due to the Google effect (digital amnesia), **navigation abilities** (McKinlay 2016; Milner 2016) **atrophied** because satnavs, cognitive rewards mechanisms are changing because of gamification, etc. This is a process that is **accelerated by technology**, and will be **magnified by the use of cognitive assistants and cognitive prosthetics**, especially for the elderly. AI itself and human-machine hybrids (either as individual cyborgs or as mixed collectives) are progressing in directions that we are not able to compare with the past or extrapolate, in order to understand where all this is leading, and the associated opportunities and risks (research priorities and safety concerns).”

Bhatnaga et al., 2018

From schools to universities and the workplace people need to develop sophisticated thinking skills that are uniquely human and not automatable through AI. These have previously been considered unmeasurable.

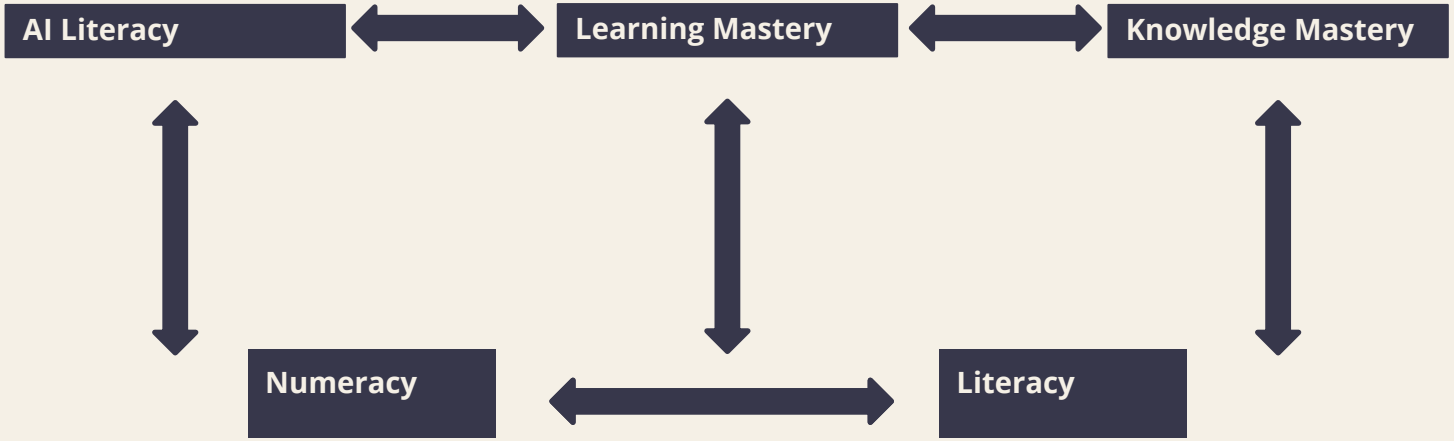
These skills, such as being good at learning, being able to plan, reflect and regulate your thinking and being able to build effective subjectively powerful relationships with others are and will continue to be at a premium in the workplace.

https://www.weforum.org/agenda/2023/05/future-of-jobs-2023-skills/

EDUCATE
VENTURES RESEARCH

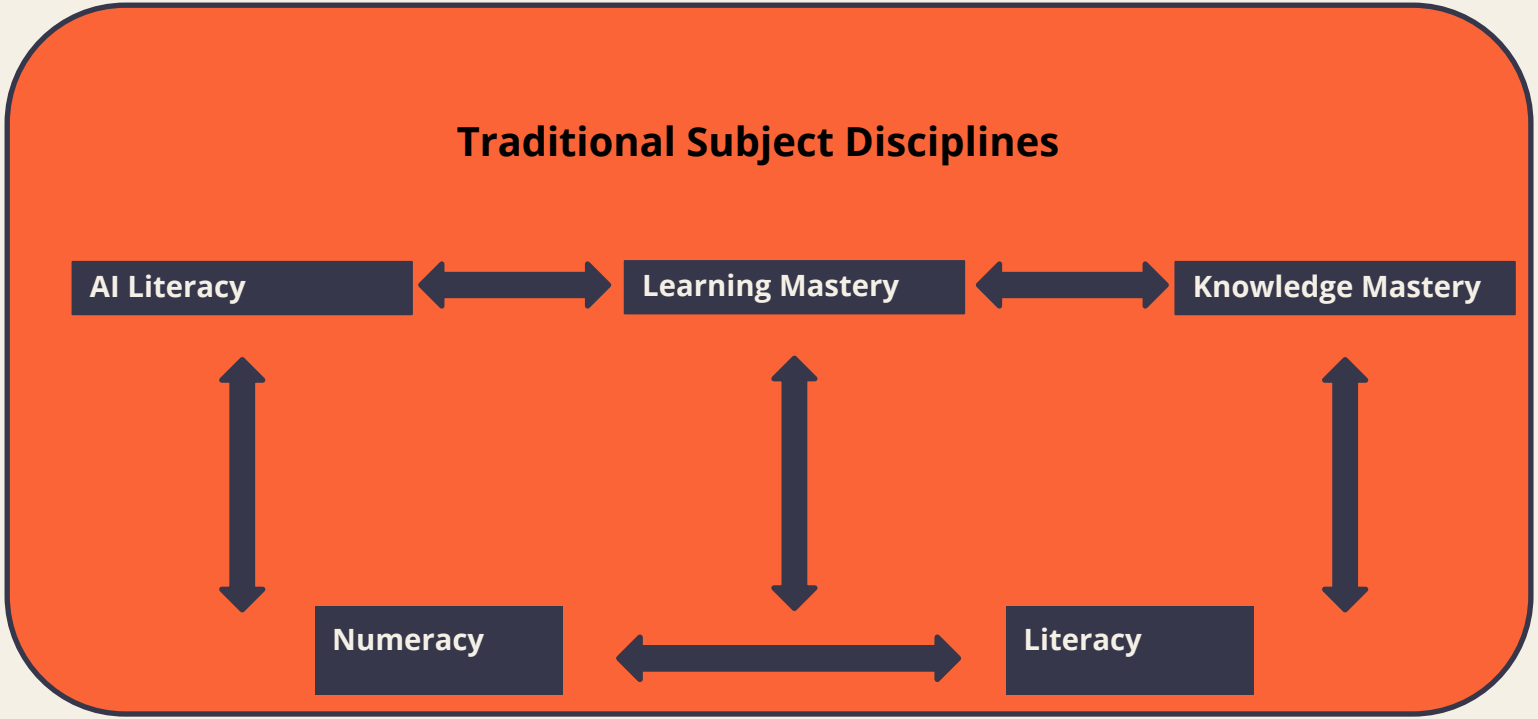
EDUCATE
VENTURES RESEARCH

What do students need to learn?



EDUCATE
VENTURES RESEARCH

What do students need to learn?

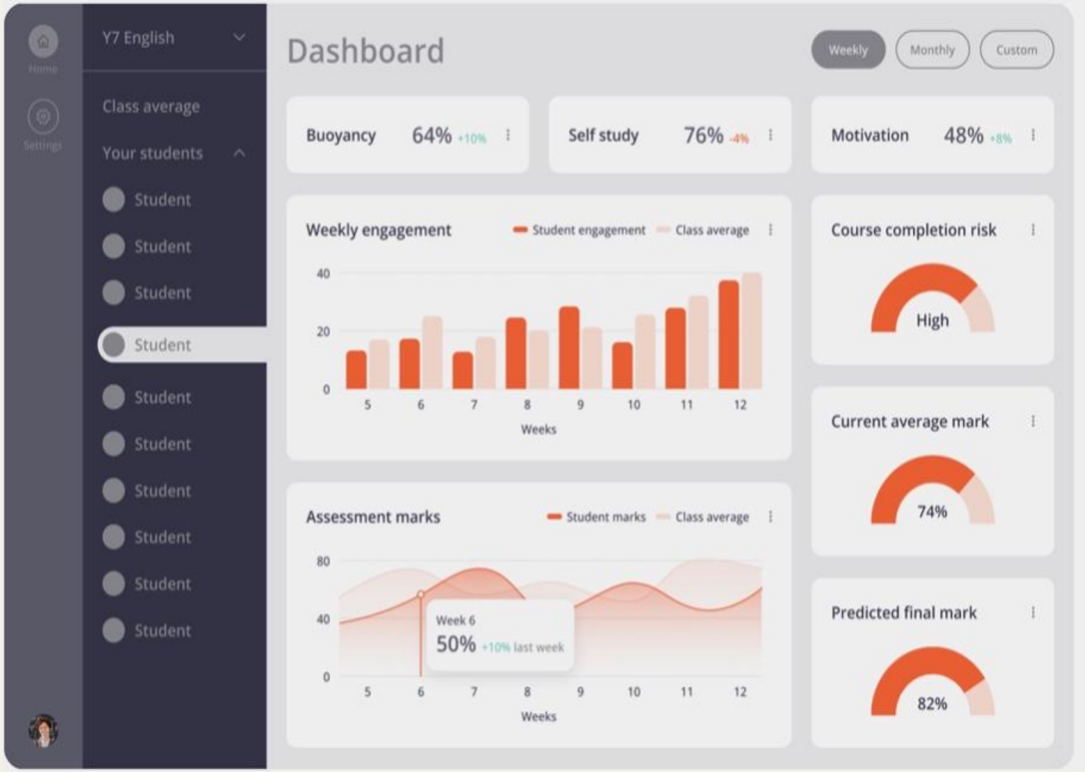


AI can help

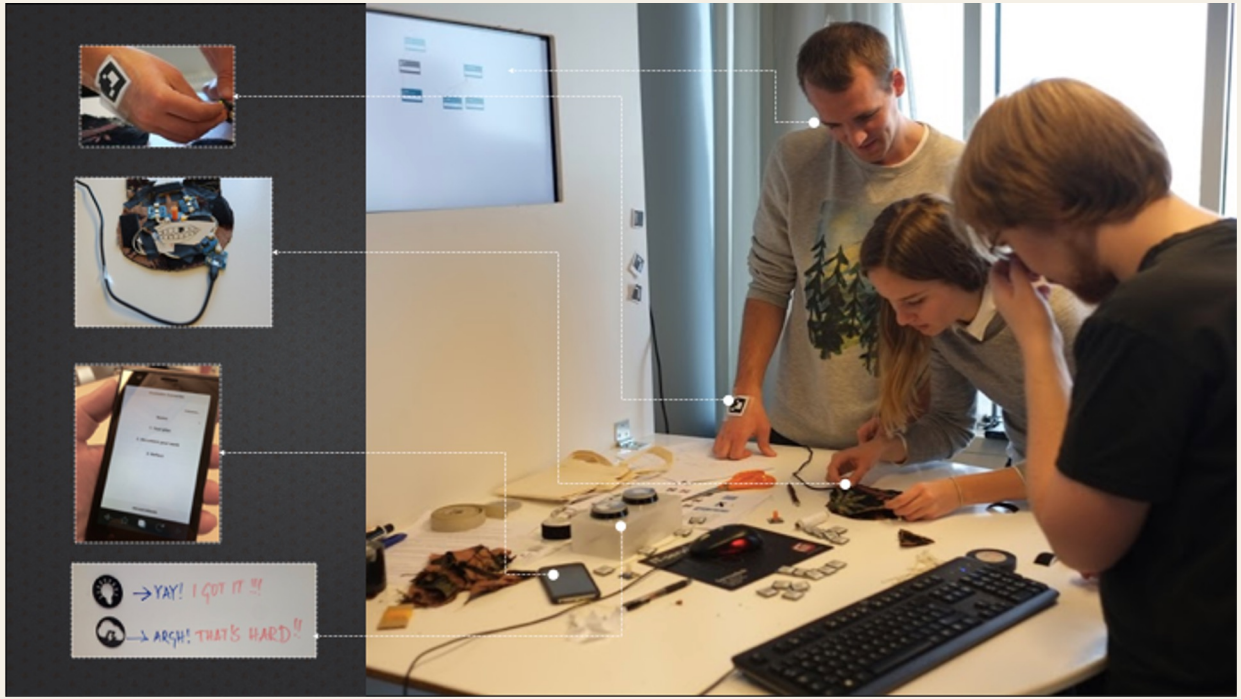
EDUCATE
VENTURES RESEARCH

AI can provide enhanced analytics that can show the learning process as it happens

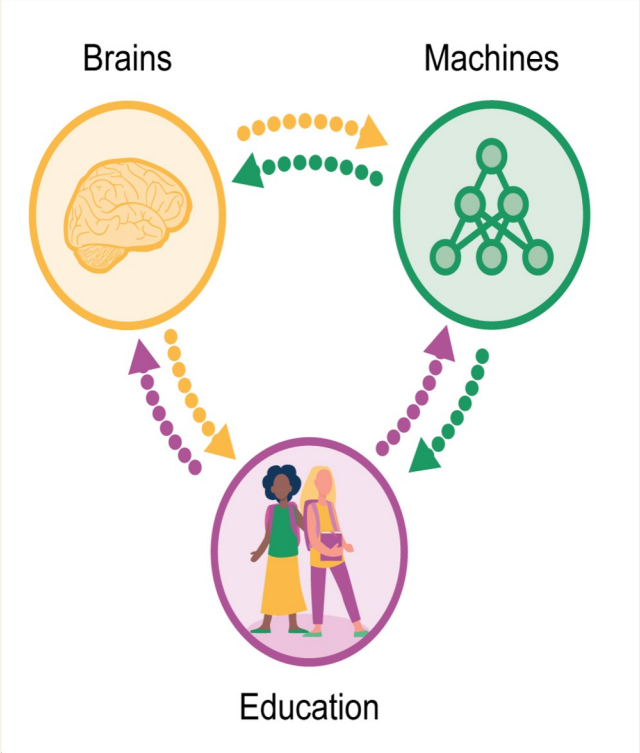
Dashboards


Y7 English
Class average
Your students
Student
Student
Student
Student
Student
Student
Student
Student
Student
Student
Dashboard
Weekly
Monthly
Custom
Buoyancy 64% +10%
Self study 76% -4%
Motivation 48% +8%
Weekly engagement
Student engagement
Class average
40
20
0
5 6 7 8 9 10 11 12
Weeks
Course completion risk
High
Current average mark
74%
Assessment marks
Student marks
Class average
80
40
0
Week 6
50% +10% last week
5 6 7 8 9 10 11 12
Weeks
Predicted final mark
82%

Multi-modal data



And add brain data …



Third Space Learning

Exploring the use of AI and machine learning techniques to support human tutors

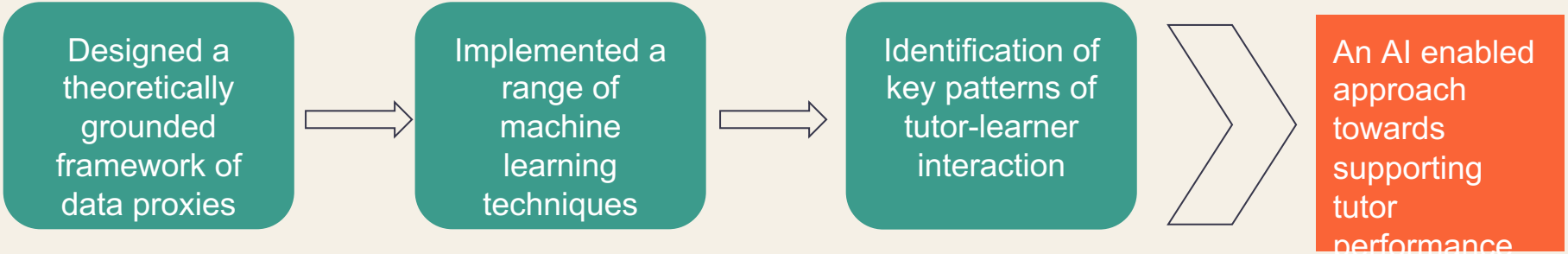
We developed a machine learning model which distinguishes between high and low performing tutors, with respect to self-regulation. This can enable an AI-driven approach towards tutor training and assessment.

Context

- Third Space Learning (TSL) provide mathematics tutoring services to primary school children, using a Virtual Classroom Environment
- As the number of tutors at TSL has exponentially grown, TSL is exploring how it can use AI to monitor tutor performance, and provide targeted, timely support to its tutors

Our approach

We developed a model to identify significant patterns of interaction which distinguished high performing tutors from low performing tutors, with respect to self-regulation



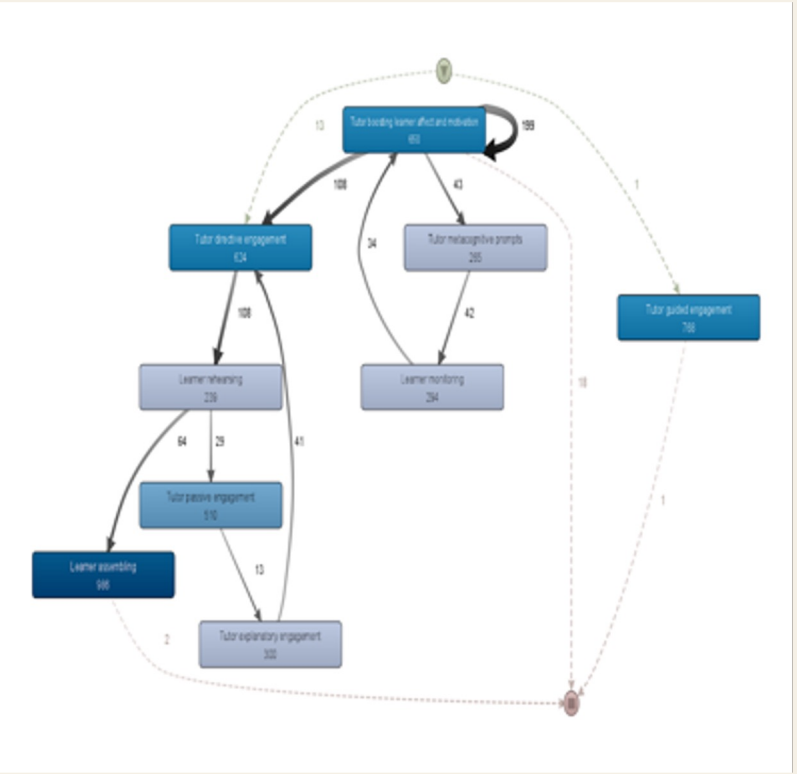
Machine learning techniques: process mining

- Following the development of the data framework, we used process mining to discover the latent processes underlying tutor-learner interactions, for high versus low performing tutors.
- We found that high performing tutors adopt a structurally different approach towards tutor-learner interactions, in comparison to low performing tutors
- High performing tutors use a complex and diverse set of tutoring practices, which build on the functionality of the VCE platform, and encourage active learner engagement
- In contrast, low performing tutors tended to use tutor-centered practices, which retained tutor control and closely followed the script of the VCE platform
- Examples of the relevant process maps are provided on the following slides. The depth of the colour of the node on the process map depicts the significance of the event, while the thickness of the line depicts the significance of the transition

Example: Process map for low performing tutors

Low ranked tutors heavily rely on a small number of practices, out of which most are tutor-centred and cede limited autonomy to the learner. Some of the significant observations are listed below.

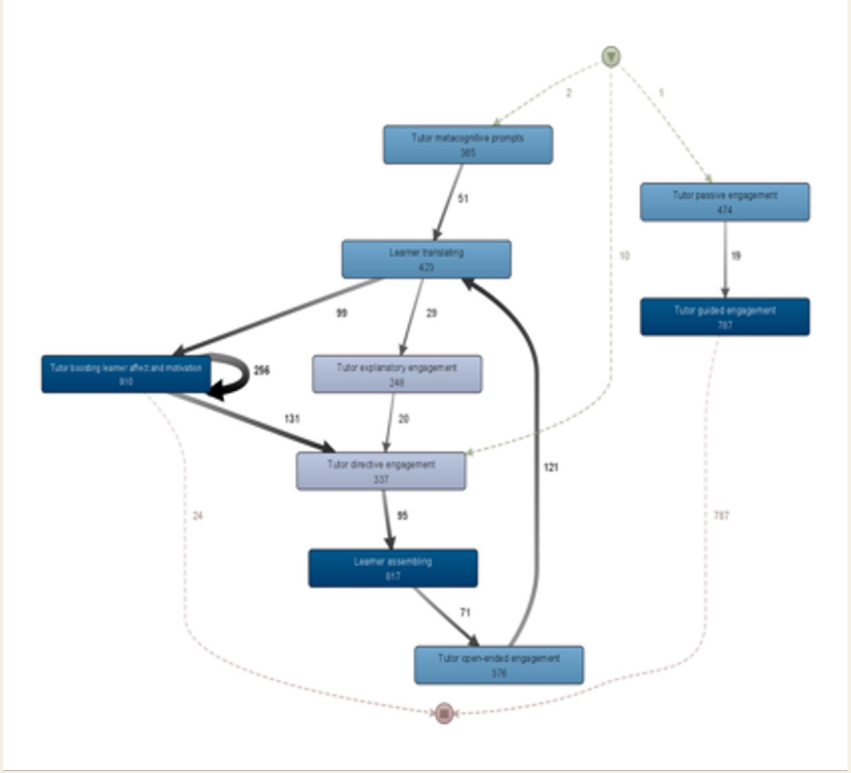
- **Tutor directive engagement** is highly prominent, both in terms of the significance of the event and key transitions to the remainder of the process. Tutor directive engagement refers to the tutor instructing the learner to take a particular action. It is a tutor centered practice and offers limited control to the learner
- There is a **loop between tutor explanatory engagement-tutor directive engagement**, indicating that **low ranked tutors repeatedly engage in tutor-centred paths** of interaction with learners
- **Tutor-learner interaction appears to be closely aligned to the VCE problem-solving activities**
- **Open ended, conceptual dialogue is not a significant feature** of the process, as indicated by the absence of tutor open ended engagement, or learner translating from the high-level process map.



Example: Process map for high performing tutors

In contrast, sessions conducted by the **high ranked group exhibit a broader range of significant events and transitions, including open-ended tutoring practices** which encourage more sophisticated learning operations.

- **Tutoring practices which encourage open ended engagement and metacognition feature prominently**
- **Learner assembling** is **highly prominent** within the process map, both in terms of the unary significance of the node, and the key transitions to other nodes. Transitions indicate that **high ranked tutors use learner activities within the VCE as a foundation to encourage sophisticated learner operations,** such as learner reasoning.
- There is a transition from **tutor passive engagement to tutor guided engagement.** This indicates that **tutors may use passive engagement to diagnose gaps in learning**, and **scaffold the learner through tutor guided engagement** rather than tutor explanatory engagement.



Intelligent tutor training and assessment

- We implemented machine learning techniques, such as pattern mining and decision trees, to identify statistically significant patterns of tutor-learner interaction
- TSL is exploring how our model can be used as the basis for an intelligent approach, towards tutor training and assessment. An intelligent dashboard, which (1) provides support for human assessors, and (2) personalised training suggestions for tutors, is under consideration

Publications

A Learning Analytics Approach to Monitoring the Quality of Online One-to-One Tutoring

Cukurova, Mutlu & Khan-Galaria, Madiha & Millán, Eva & Luckin, Rose. (2022). A Learning Analytics Approach to Monitoring the Quality of Online One-to-One Tutoring. Journal of Learning Analytics. 9. 1-16. 10.18608/jla.2022.7411.

AI can help us build a ‘fitbit’ for the mind

EDUCATE
VENTURES RESEARCH

A ‘Fitbit’ for your mind

EDUCATE VENTURES RESEARCH

Step 1: Select your advanced thinking expertise from those identified by The World Economic Forum’s Future of Jobs 2023

Cognitive	Technology skills	Working with Others	Self-efficacy
Analytical thinking	Technological Literacy	Empathy and active listening	Motivation and self-awareness
Creative thinking	AI and Big data	Leadership and social influence	Resilience, flexibility and agility
Systems thinking			Curiosity and lifelong learning
			Dependability and attention to detail

https://www.weforum.org/agenda/2023/05/future-of-jobs-2023-skills/

A ‘Fitbit’ for your mind

EDUCATE VENTURES RESEARCH

Step 1: Select your advanced thinking expertise from those identified by The World Economic Forum’s Future of Jobs 2023

Cognitive	Technology skills	Working with Others	Self-efficacy
Analytical thinking	Technological Literacy	Empathy and active listening	Motivation and self-awareness
Creative thinking	AI and Big data	Leadership and social influence	Resilience, flexibility and agility
Systems thinking			Curiosity and lifelong learning
			Dependability and attention to detail

https://www.weforum.org/agenda/2023/05/future-of-jobs-2023-skills/

A ‘Fitbit’ for your mind

EDUCATE
VENTURES RESEARCH

Step 1 Select your target expertise

Motivation and self-awareness

Step 2 Complete the diagnostic

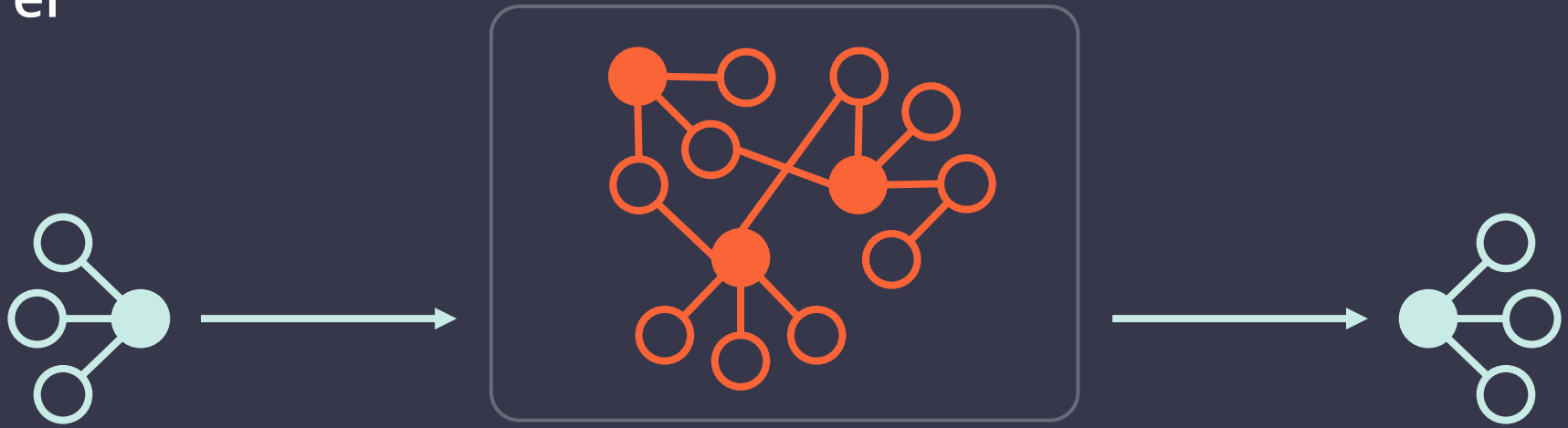
Diagnostic completed

Step 3 Now upload your data

Upload

In A ‘Fitbit’ for your mind

er



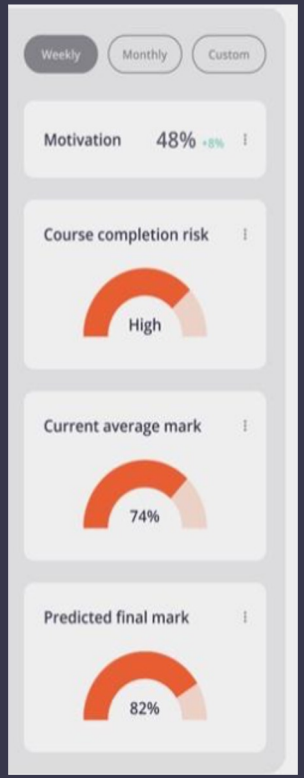
Data	Analytics and AI	Learning insights
Ex Data collected via diagnostics and a data ingestion engine	In Analysis conducted according to user preferences	Actionable insights about the selected thinking capabilities and how they could be improved

data sig

A ‘Fitbit’ for your mind insights report

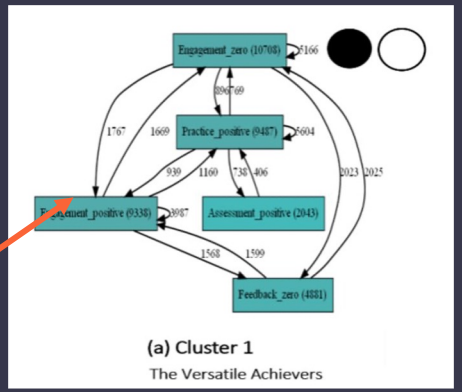
EDUCATE VENTURES RESEARCH

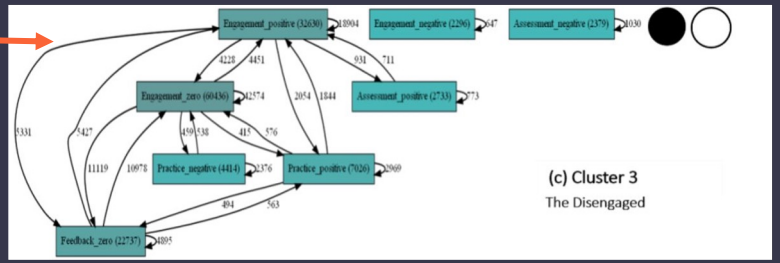
Your selected thinking capability | Motivation and self-awareness



You behaviour patterns look like this.
People with more advanced self-awareness and consistent motivation exhibit patterns of behaviour look like this.

Read more to learn how to improve...





1

AI tools:

Using AI in Education to tackle some of the big educational challenges

2

Increasing our Human Intelligence:

Changing Education so that we focus on human intelligence and prepare people for an AI world

3

Learning about AI:

Educating People about AI so that they can use it safely and effectively

Artificial intelligence in Education

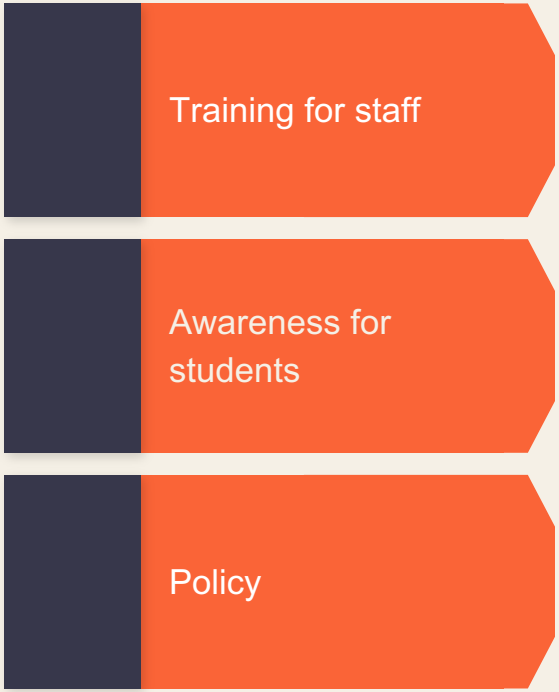
EDUCATE

VENTURES RESEARCH

Learning about AI

Educating People about AI so that they can use it safely and effectively

How might we go about that?



- What is AI? What tools are available?
- How might you use it in your teaching?
- What are the risks?

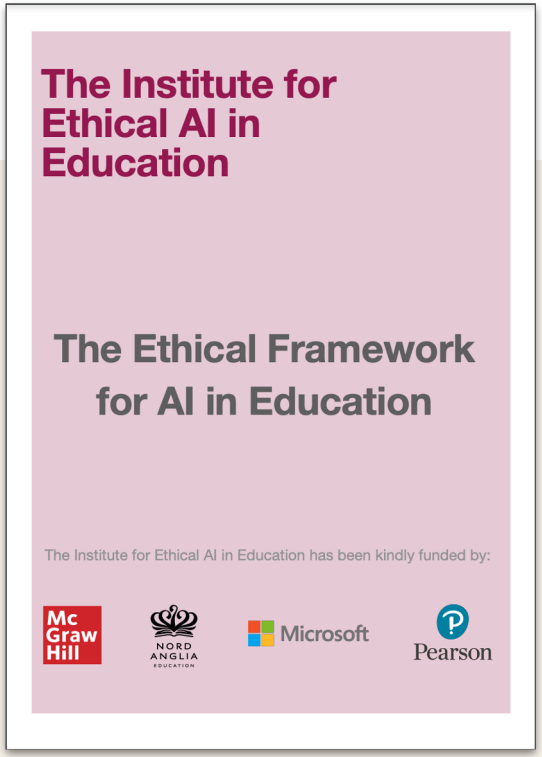
- What is AI? What tools are available?
- How should you consider using it?
- Will this impact my future?

- What is our AI policy as an institution?
- How can we ensure equal access?
- Ethics – NB the IEAIED

IOE professor co-founds the UK's first Institute for Ethical Artificial Intelligence in Education

18 October 2018

conceived by Sir Anthony Seldon, Priya Lakhani OBE, and Professor Rose Luckin



FREE TO DOWNLOAD https://www.buckingham.ac.uk/wp-content/uploads/2021/03/The-Institute-for-Ethical-AI-in-Education-The-Ethical-Framework-for-AI-in-Education.pdf

Objective		Criteria	Checklist
Transparency and Accountability. Humans are ultimately responsible for educational outcomes and should therefore have an appropriate level of oversight of how AI systems operate (See Annex Section 7 for justification)	7.1	Conduct a risk assessment to establish whether AI resources could undermine the authority of practitioners and disrupt accountability structures, and take action based on the risk assessment	Will implementing the actions arising from this risk assessment ensure that the authority of educators and/or other relevant practitioners is not undermined, and that accountability structures are not disrupted as a result of using AI? **(Pre-procurement)**
	7.2	Insist that suppliers make explicit whether there were any trade-offs between accuracy and explainability in the design of the AI resource, specifying where any compromises have been made and providing a justification	Have you received the relevant information from the suppliers? Where compromises have been made, are you satisfied with the justification you have received? **(Pre-procurement)**
Informed Participation. Learners, educators and other relevant practitioners should have a reasonable understanding of artificial intelligence and its implications (See Annex Section 8 for justification)	8.1	Teach students about artificial intelligence and its societal and ethical implications	Where in the curriculum, or when during extracurricular time, will students be taught about this? What content will they learn? **(Implementation)**
	8.2	Provide educators and/or other relevant practitioners with sufficient training to ensure that they are able to use AI resources effectively, discerningly and with confidence. As part of this training, educators and practitioners should be trained to scrutinise the decisions made and behaviours displayed by AI systems, in order to guard against undue deference	What will the content of this training be, and how much training will educators and/or other relevant practitioners receive? **(Implementation)**
Ethical Design. AI resources should be designed by people who understand the impacts these resources will have (see Annex Section 9 for justification)	9.1	Insist that suppliers provide relevant information to confirm that a range of stakeholders (e.g. learners, educators, careers advisers, youth workers) were consulted as part of the design process	What information have you received from the suppliers, and are you satisfied that a range of stakeholders (e.g. learners, educators, careers advisers) were consulted as part of the design process? **(Pre-procurement)**
	9.2	Insist that suppliers provide relevant information to confirm that a diverse range of people contributed to the design and development of the AI resource	What information have you received from the suppliers, and are you satisfied that a diverse range of people contributed to the design of the AI resource? **(Pre-procurement)**
	9.3	Ensure that the supplier can confirm that AI resources were designed by practitioners who have had training on the ethical implications of AI in education	What information have you received from the suppliers, and are you satisfied that AI resources were designed by practitioners who have had training on the ethical implications of AI in education? **(Pre-procurement)**

Objectives:

1. Achieving Educational Goals
2. Forms of Assessment
3. Administration and Workload
4. Equity
5. Autonomy
6. Privacy
7. Transparency and Accountability
8. Informed Participation
9. Ethical Design

To conclude

- The rise in popularity and adoption of generative AI systems has challenged traditional beliefs about the capabilities of AI;
- This moment signals the need for a fundamental shift in the way we approach assessments in education.
- We need to assess self-awareness, self-regulation, metacognition, and the other essential sophisticated thinking capabilities required to future-proof careers.
- The irony of the situation is that AI is both a catalyst for change and a potential solution to the challenges posed by its presence.
- The judicial application of AI within education can enable formative assessments that contribute to the teaching and learning process and provide evidence of each student's level of understanding and skill.

EDUCATE
VENTURES RESEARCH

The first National Benchmarking Study – please take part. For further information see and click on the QR code.

Host of the EdTech Podcast

Professor Rose Luckin

EVR Products & Services

AI CPD for Schools

AI Strategy Development for Schools

Bespoke AI & Data Science Consultancy

hello@educateventures.com

educateventures.com

EDUCATE VENTURES RESEARCH

Thank You

EDUCATE
VENTURES RESEARCH