Keynote 2: Universities as Catalysts for Change: How AI amplifies Education for Sustainable Development (ESD)

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Flinders University

Agenda

- The Changing Landscape of Sustainability and Higher Education
- Transforming Sustainability Education, Research and Operation with AI
- Towards Ethical and Responsible Adoption of AI for ESD in Higher Education

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A Planet in Urgency

- **Urgent action** is needed to address the dramatic interrelated challenges the world is facing:
- The climate crisis, mass loss of biodiversity, pollution, pandemic diseases, extreme poverty and inequalities, violent conflicts, and other **environmental**, **social** and **economic** crises endanger life on our planet.

We are in a battle for our lives. But it is a battle we can win..

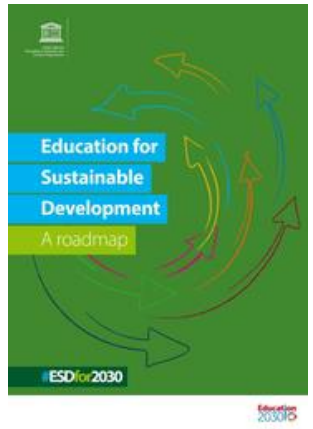
UN Secretary-General, Antonio Guterres

17 Goals to Transform Our World

https://www.un.org/sustainabledevelopment/sustainable-development-goals/

The Need for a Sustainable Future

- **Education for Sustainable Development** (ESD), anchored in SDG 4.7 and as an enabler for all 17 SDGs, is the foundation for the required transformation, providing everyone with the knowledge, skills, values and attitudes to become change agents for sustainable development.



The Promise and Paradox of ESD

- ESD enables learners to develop their cognitive and non-cognitive skills, such as critical thinking and competences for collaboration, problem solving, coping with complexity and risk, building resilience, thinking systemically and creatively, and empowering them to take responsible action as global citizens

Times Higher Education

Sustainability Impact Ratings

Current Limitations of ESD in Higher Education

- Fragmented ESD in Curricula
- Low engagement
- Imbalance between global perspective and local relevance

- ESD demands learners who can imagine alternatives and act collectively. But often, we teach sustainability as content — not as lived, participatory transformation.”

The Ubiquitousness across Sectors

ChatGPT

Copilot

Gemini

Deepseek R1

Claude

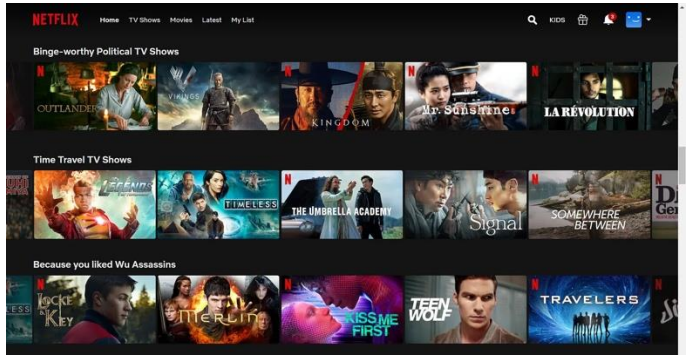
Artificial Intelligence (AI) is NOT a new concept

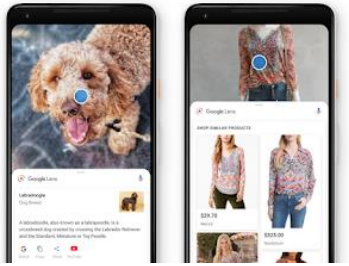
- Conceptualised in the 1950s
- As an umbrella term and evolving concept, can be understood as a technology genre, with:

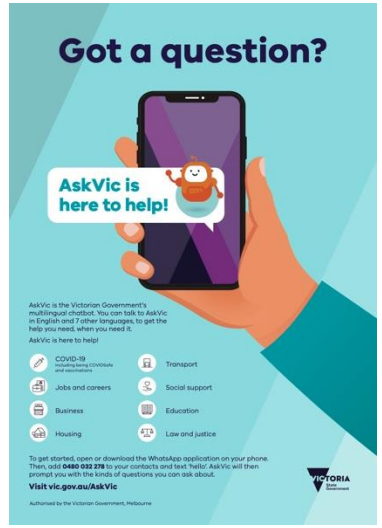
The capacity of computers or systems to exhibit or simulate intelligent behaviours.

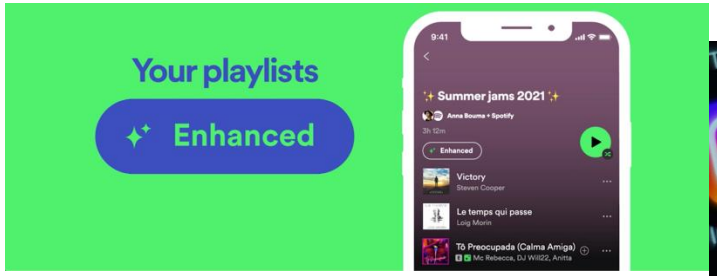
John McCarthy, Dartmouth Conference, 1956

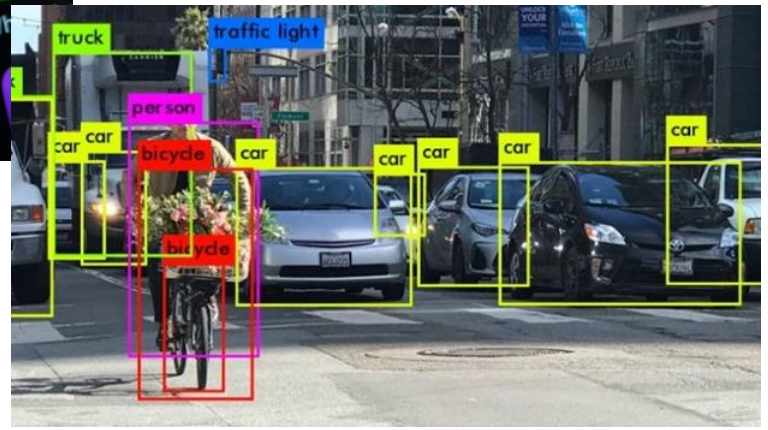
AI is something you've likely been using in daily life.











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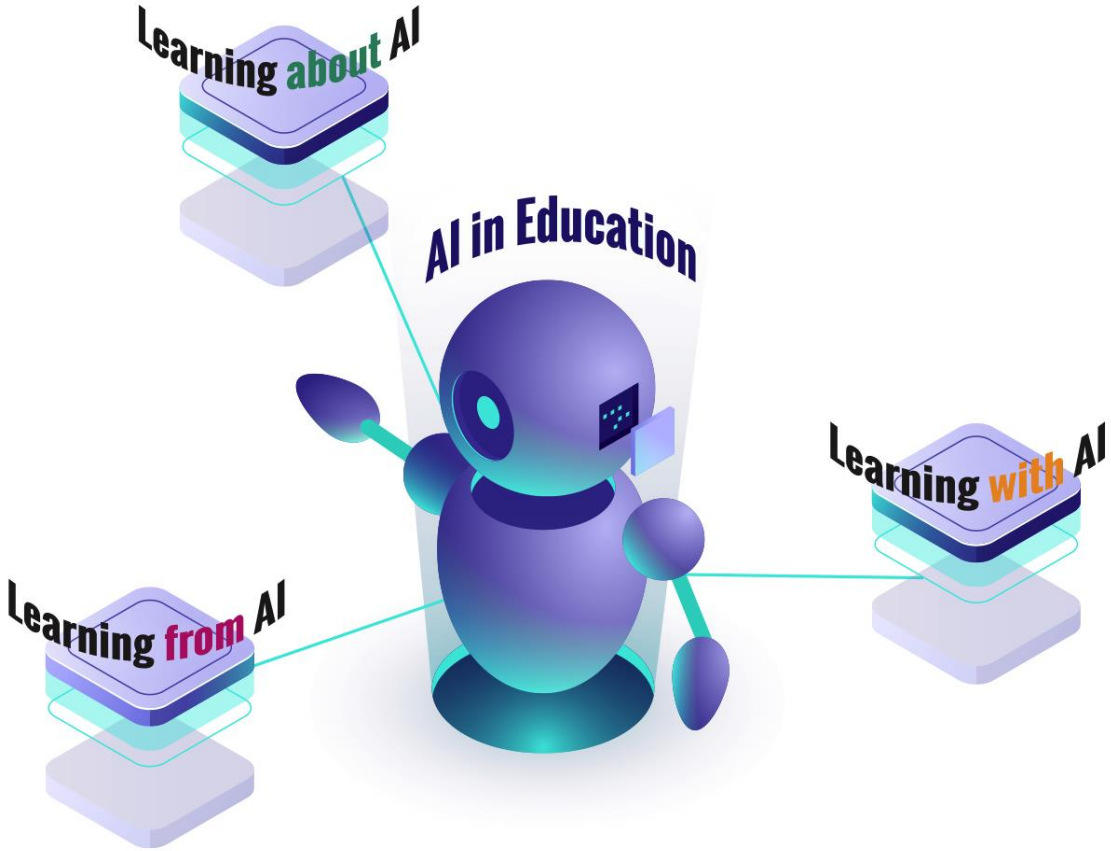
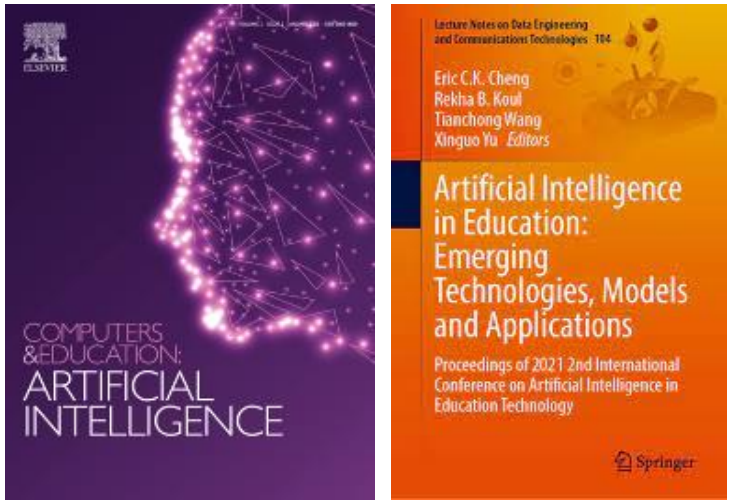
- AI is a Disruptive

Towards a Holistic Approach to AI in Education



(Wang & Cheng, 2021; 2022)



Wang, T., & Cheng, E. C. K. (2021). An investigation of barriers to Hong Kong K-12 schools incorporating Artificial Intelligence in education. *Computers and Education: Artificial Intelligence (2)*.

Wang, T., & Cheng, E. C. K. (2022). Towards A Tripartite Research Agenda: A Scoping Review of Artificial Intelligence in Education Research. In E. C. K. Cheng, R. B. Koul, T. Wang, & X. Yu (Eds.), Artificial Intelligence in Education: Emerging Technologies, Models and Applications. Singapore: SpringerNature.

Three Paradigms of AI in Education

- Learning from AI: AI serves as a source of knowledge and the means by which students learn
- Learning about AI: Equipping learners AI-related knowledge, skills and values so that they can thrive in an AI-saturated future
- Learning with AI: Using AI tools to improve learning and teaching practices

Why AI Matters for ESD

- A Transformative Force
- AI enables adaptive, data-informed, contextualised learning.
- Supports interdisciplinary and systems-thinking competencies.
- Empowers universities to model sustainability through smart operations.

nature communications

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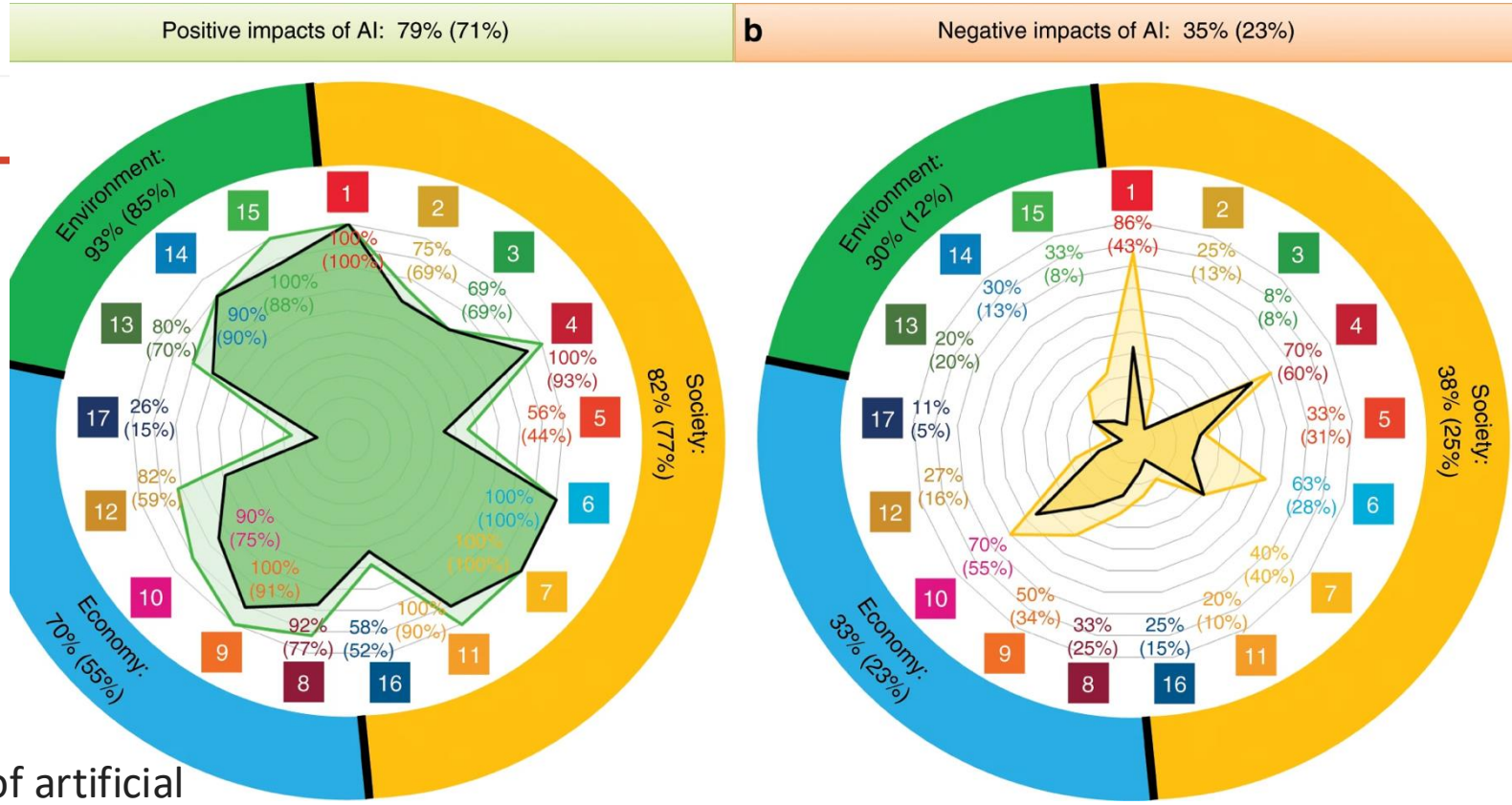
Perspective | Open access | Published: 13 January 2020

The role of artificial intelligence in achieving the Sustainable Development Goals

Ricardo Vinuesa ✉, Hossein Azizpour, Iolanda Leite, Madeline Balaam, Virginia Dignum, Sami Domisch, Anna Felländer, Simone Daniela Langhans, Max Tegmark & Francesco Fuso Nerini ✉

Nature Communications **11**, Article number: 233 (2020) | Cite this article

564k Accesses | **2226** Citations | **942** Altmetric | Metrics

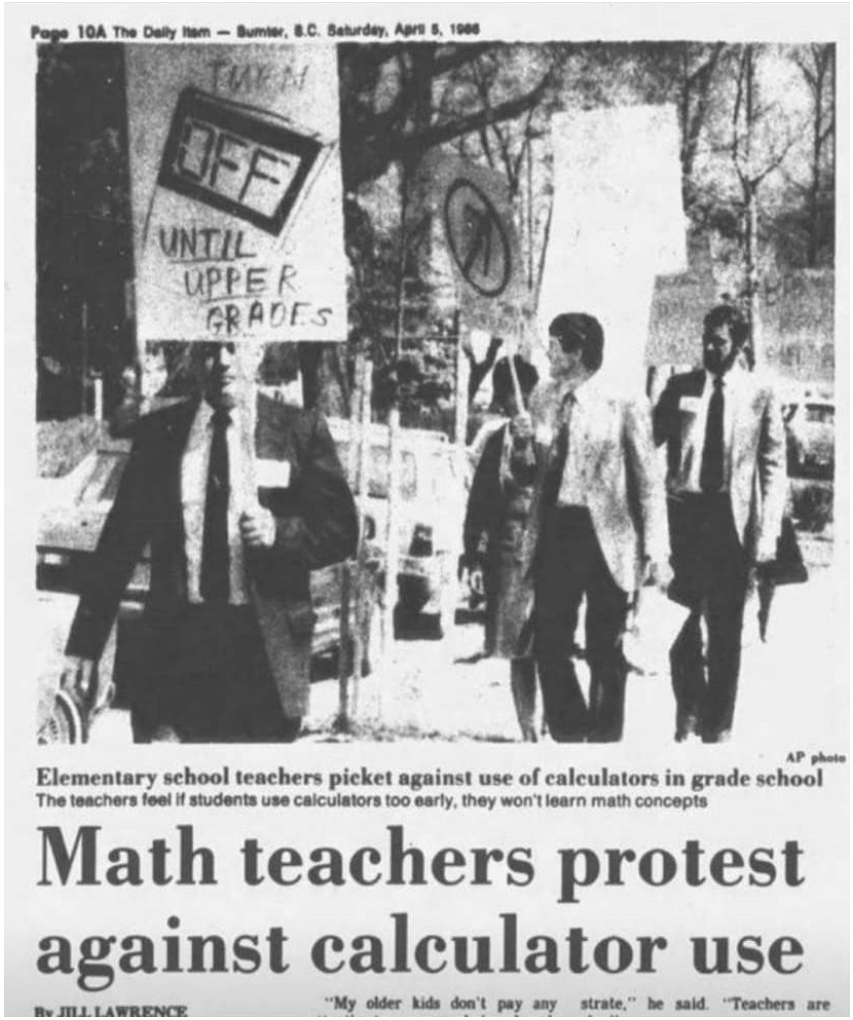


Documented evidence of the potential of AI acting as (**a**) an enabler or (**b**) an inhibitor on each of the SDGs.

Vinuesa, R., Azizpour, H., Leite, I. *et al.* The role of artificial intelligence in achieving the Sustainable Development Goals. *Nat Commun* **11**, 233 (2020). https://doi.org/10.1038/s41467-019-14108-y

Academic Integrity (cheating, plagiarism) Concerns

If history has taught us anything…



Page 10A The Daily Item — Sumter, S.C. Saturday, April 5, 1986

AP photo

Elementary school teachers picket against use of calculators in grade school

The teachers feel if students use calculators too early, they won't learn math concepts

Math teachers protest against calculator use

By JILL LAWRENCE

"My older kids don't pay any strate," he said. "Teachers are

"Teachers feel if students use calculators too early, they won't learn math concepts".

- 1988

Vol. 14 No. 1 Winter 2006 Published by The National Center for Public Policy and Higher Education

The Plagiarism Plague

In the internet era, cheating has become an epidemic on college campuses

By Don Campbell

ATLANTA

THE PROBLEM OF CHEATING in academia hit Tom Lancaster in a very personal way more than a decade ago: The Emory University political science professor found his own research being plagiarized by one of his students.

Lancaster, now senior associate dean for undergraduate studies, had learned while researching elections in Greece that women and men use different polling booths and that their votes are recorded by gender.

He subsequently had his students enter the polling data from each precinct and do papers comparing gender voting patterns in different sections of Greece. Two years later, in a similar class on southern European politics, a student wrote a paper about gender differences in voting in Greece—even though that topic was not assigned—using data that could only have been obtained from students in the previous class.

"The student," said Lancaster, "had clearly in my mind simply plagiarized a previous paper—not necessarily the words—but had simply pulled out the data." Lancaster took the case to the Emory honor council, but the council judged the student not guilty because the data had not been published. The student admitted finding it in a fraternity file.

Students can use computers, cellphones, and other high-tech gadgets to cheat and plagiarize their way to better grades.

To add insult to injury, after Lancaster gave the student an F in the course, he found out a year later that the grade was changed without his being notified.

"It really was the shot across the bow for me," said Lancaster, who has been a crusader for a more stringent honor code and judicial process at Emory ever since.

Today, in the era of the internet and other high-tech gadgetry, Lancaster's story

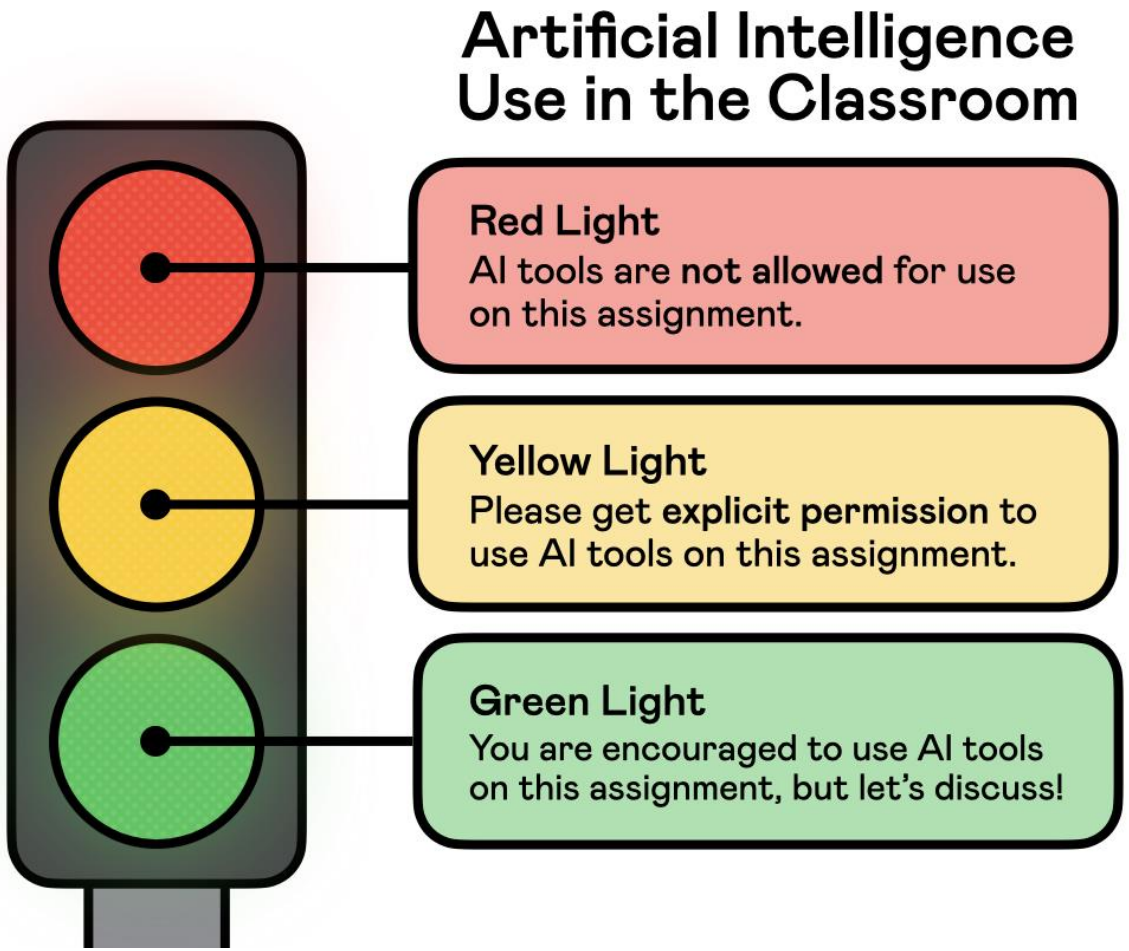
continued on page 15

ROBIN NELSON, BLACK STAR, FOR CROSSTALK

"Internet plagiarism is probably by far the most common form of cheating or academic dishonesty," says Didi Kuo, a 2005 Emory University graduate who chaired the university's honor council.

	Short-term	Medium-term	Long-term
1. Ignore	Might get away with it momentarily		
2. Ban	Problematic	Becomes risky	
3. Invigilate	Where appropriate	Where appropriate	Where appropriate
4. Embrace	Being mindful of equity issues	Where appropriate	
5. Design around	Risky		
6. Rethink	Requires time and effort		

The “Traffic Light” System



Can I Use AI on this Assignment?

Generative AI Acceptable Use Scale

Generative AI refers to any of the thousands of Artificial Intelligence tools in which the model generates new content (text, images, audio, video, code,etc) This includes, but is not limited to, Large Language Models/ LLMs such as ChatGPT, Google Gemini,etc, Image creators such as Dall-E3, Adobe Firefly, and any tools with built in generative AI capabilities such as Microsoft CoPilot, Google Duet, Canva, etc etc)

	Level of AI Use	Full Description	Disclosure Requirements
0	NO AI Use	This assessment is completed entirely without AI assistance. AI Must not be used at any point during the assessment. This level ensured that student rely solely on their own knowledge, understanding, and skills.	No AI disclosure required May require an academic honesty pledge that AI was not used.
1	AI-Assisted Idea Generation and Structuring	No AI content is allowed in the final submission. AI can be used in the assessment for brainstorming, creating structures, and generating ideas for improving work.	AI disclosure statement must be included disclosing how AI was used. Link(s) to AI chat(s) must be submitted with final submission.
2	AI-Assisted Editing	No new content can be created using AI. AI can be used to make improvements to the clarity or quality of student created work to improve the final output.	AI disclosure statement must be included disclosing how AI was used. Link(s) to AI chat(s) must be submitted with final submission.
3	AI for Specified Task Completion	AI is used to complete certain elements of the task, as specified by the teacher. This level requires critical engagement with AI generated content and evaluating its output. You are responsible for providing human oversight and evaluation of all AI generated content.	All AI created content must be cited using proper MLA citation. Link(s) to AI chat(s) must be submitted with final submission.
4	Full AI Use with Human Oversight	You may use AI throughout your assessment to support your own work in any way you deem necessary. AI should be a ‘co-pilot’ to enhance human creativity. You are responsible for providing human oversight and evaluation of all AI generated content.	You must cite the use of AI using proper MLA or APA citation. Link(s) to AI chat(s) must be submitted with final submission.

From One-Size-Fits-All to Responsive Learning ecosystems

- AI-driven adaptive learning tailors content to learner profiles:

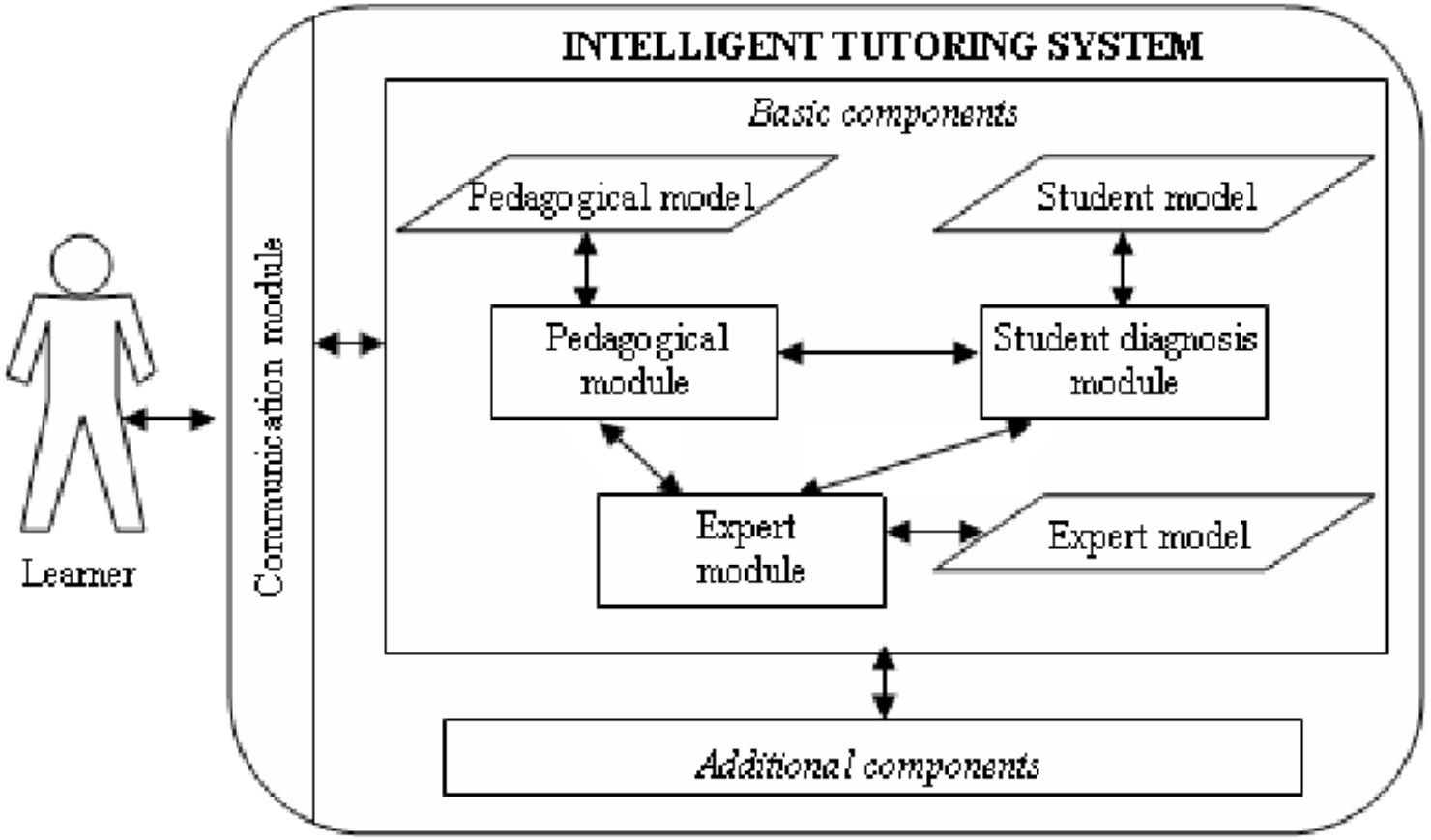
Prior knowledge, discipline, regional context.

- AI diagnoses misconceptions, scaffold inquiry, personalise feedback.
- Enables development of core ESD competencies:

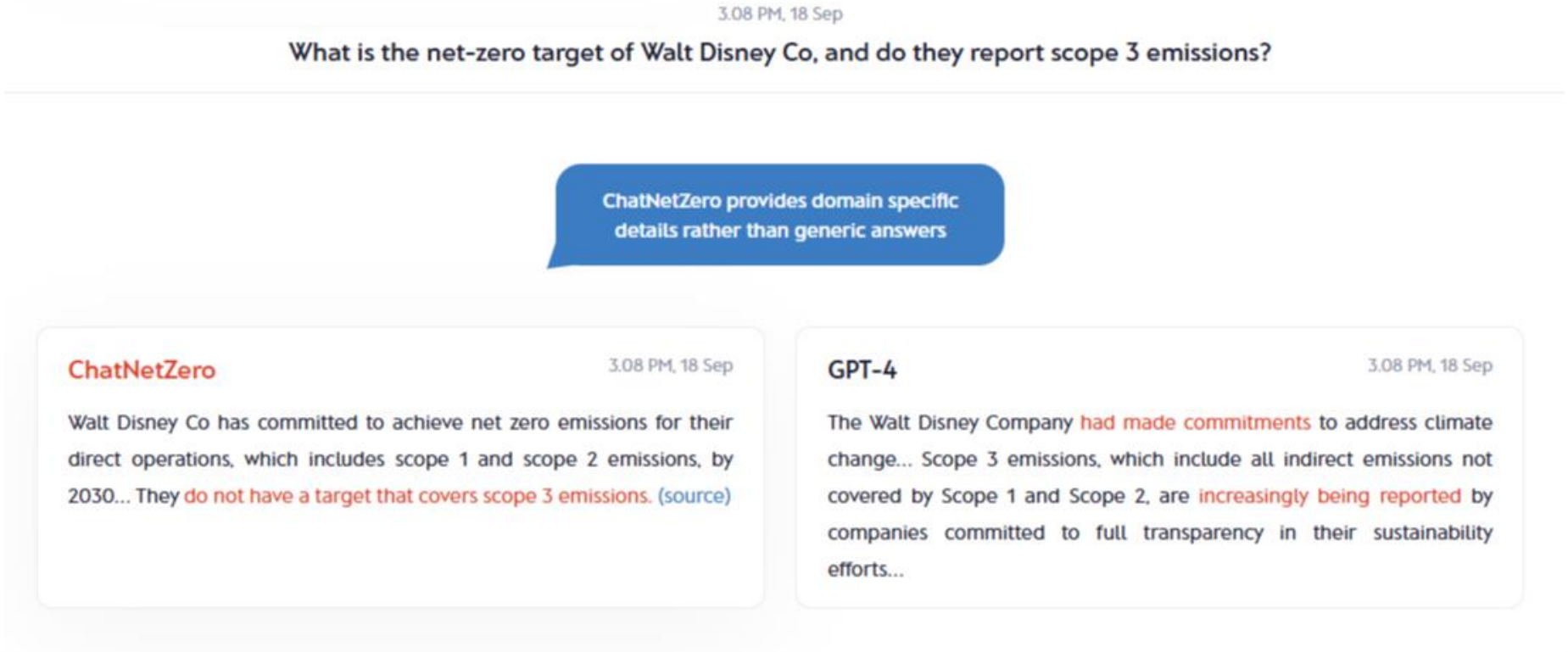
systems thinking, anticipatory reasoning, ethical action.

- Creates relevance and engagement across cultural and socio-economic contexts.

Intelligent Tutoring Systems



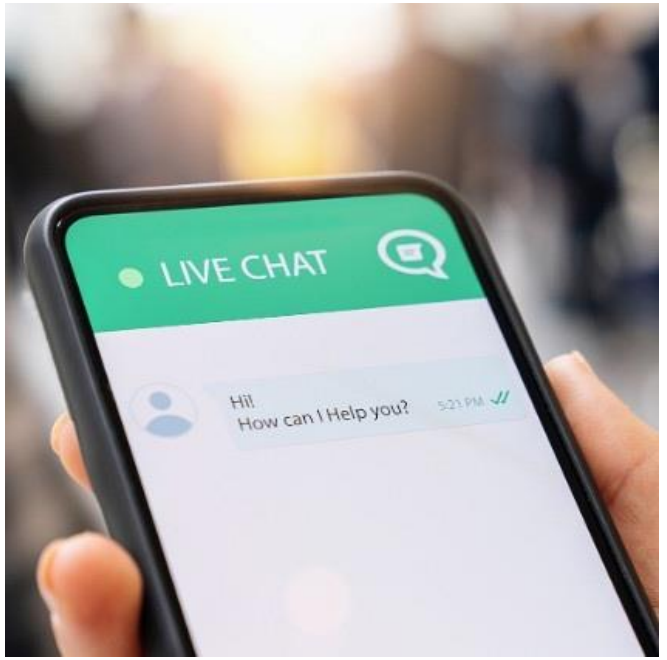
ChatNetZero is the world's first climate target chatbot. The tool uses specially trained LLMs on a live database tracking thousands of public decarbonization targets to demystify climate commitments.



How AI chatbots drive eco-friendly practices

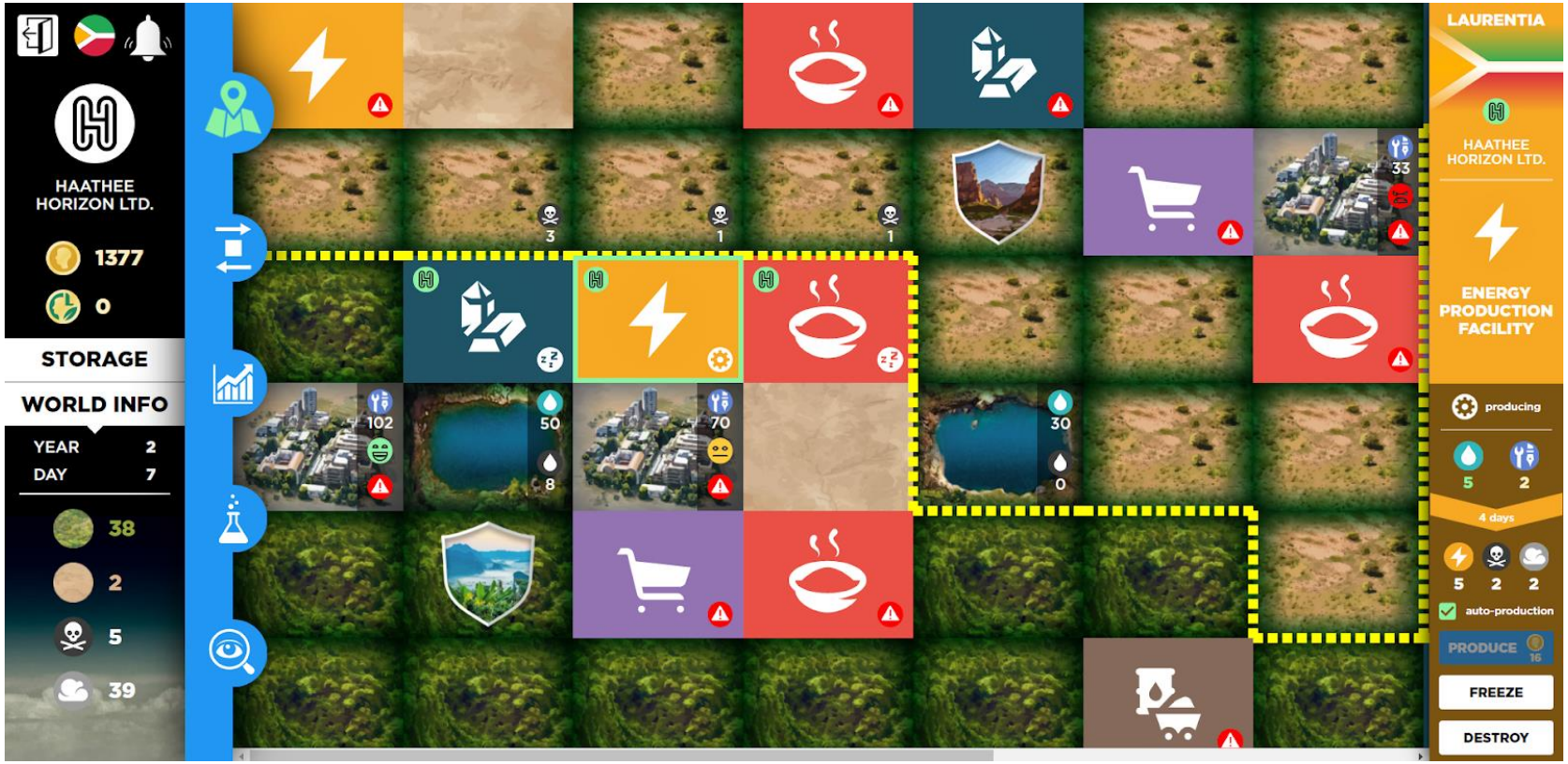
beetroot

- Raising environmental awareness
- Practical eco-friendly tips
- Personalization
- Real-time user updates
- Community building
- Integration into daily life
- Actionable data-driven insights
- Instant access to educational resources



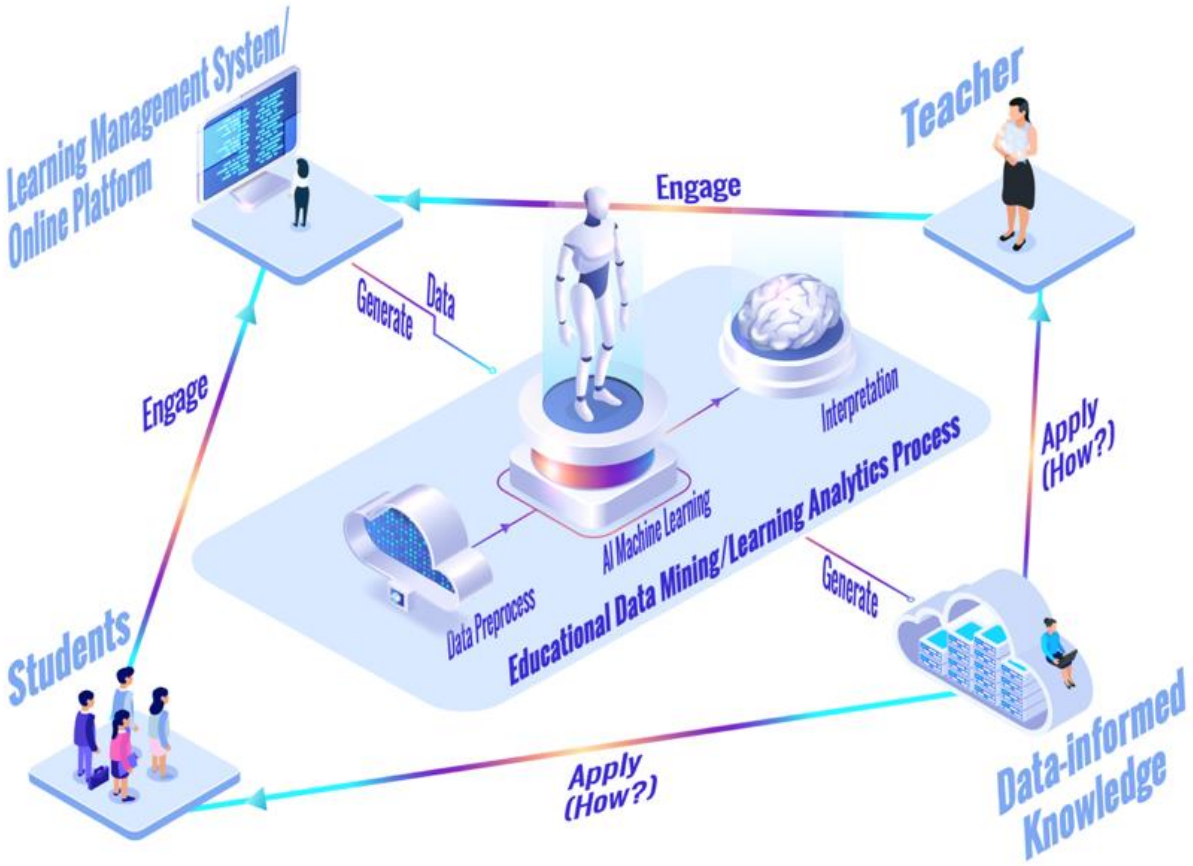
AI-powered virtual labs simulate ecological and social systems

- Dynamic simulations model real-world complexity (e.g., climate, economy, society).
- Learners witness cascading effects of decisions — fostering systems thinking and socio-emotional learning.
- Enables safe exploration of policy trade-offs (e.g., water vs energy vs food)
- Cultivates systems thinking and ethical reasoning
- When learners *see* and *feel* the ripple effects of their decisions, sustainability shifts from abstraction to agency.



These immersive systems cultivate *agency*. Students learn not through lectures, but by navigating uncertainty — as real sustainability leaders do.


SAVE THE FUTURE
Centre for Systems Solutions
SOCIAL SIMULATIONS
SOCIAL SIMULATION ABOUT LONG-TERM SOLUTIONS


Learning Management System/
Online Platform
Teacher
Engage
Generate
Data
Engage
Interpretation
AI Machine Learning
Educational Data Mining/Learning Analytics Process
Data Preprocess
Apply
(How?)
Generate
Students
Apply
(How?)
Data-informed
Knowledge


Students Per Performance Band
No Risk
Minimal Risk
Moderate Risk
Extreme Risk
40%
20%
20%
Students At Risk
At Risk
Not At Risk
40%
60%
Displaying 1 to 10 of 10
More...
Search
Student ID
Last Name
First Name
Overall Score
Overall Label
Attendance
Failures
Incidents
1 One Student 55 Moderate Risk Moderate Risk Moderate Risk Moderate Risk
10 Ten Student 90 No Risk Moderate Risk No Risk No Risk
2 Two Student 70 Minimal Risk Extreme Risk No Risk No Risk
3 Three Student 95 No Risk No Risk No Risk Moderate Risk
4 Four Student 90 No Risk No Risk Moderate Risk No Risk
5 Five Student 100 No Risk No Risk No Risk No Risk
6 Six Student 15 Extreme Risk Extreme Risk Extreme Risk Moderate Risk
7 Seven Student 75 Minimal Risk Moderate Risk No Risk Moderate Risk
8 Eight Student 40 Moderate Risk Moderate Risk Moderate Risk Extreme Risk
9 Nine Student 15 Extreme Risk Extreme Risk Extreme Risk Moderate Risk
Show 50
← Previous
1
Next →
Add to Intervention Group

Accelerating Sustainability Research: AI as a Research Partner

- **Climate Modelling (SDG 13):** Hyper-local predictions for adaptive policy.
- **Biodiversity (SDGs 14–15):** AI classifies species, integrates indigenous knowledge.
- **Agriculture & Food Security (SDGs 2 & 12):** Synthesises climate, soil, and cultural data.
- **Urban Sustainability (SDG 11):** AI visualises policy trade-offs across sectors.
- **Global Collaboration (SDG 17):** NLP breaks language barriers; citizen science platforms democratise research.

nature sustainability

Analysis | Open access | Published: 21 July 2025

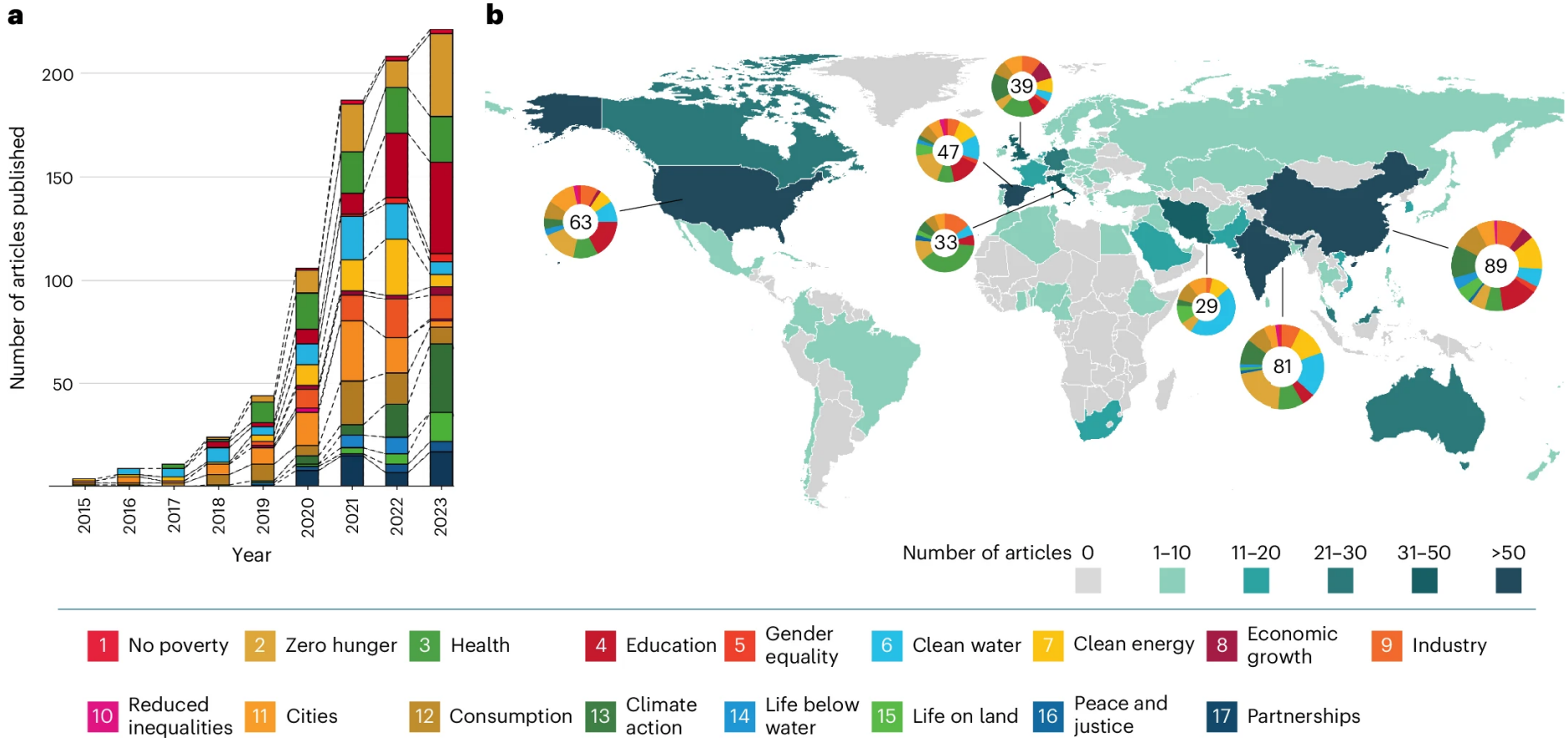
Artificial intelligence in sustainable development research

C. Gohr ✉, G. Rodríguez ✉, S. Belomestnykh, D. Berg-Moelleken, N. Chauhan, J.-O. Engler, L. V. Heydebreck, M. J. Hintz, M. Kretschmer, C. Krügermeier, J. Meinberg, A.-L. Rau, C. Schwenck, I. Aoulkadi, S. Poll, E. Frank, F. Creutzig, O. Lemke, M. Maushart, J. Pfendtner-Heise, J. Rathgens & H. von Wehrden

Nature Sustainability **8**, 970–978 (2025) | Cite this article

Gohr, C., Rodríguez, G., Belomestnykh, S. *et al.* Artificial intelligence in sustainable development research. *Nat Sustain* **8**, 970–978 (2025). https://doi.org/10.1038/s41893-025-01598-6

Global distribution and publication years of the 792 scientific articles analysed



	Vegetation	Water	Forecasting	Remote sensing	Clean energy	Health care	Education	Industry	Total
Forecasting	15	32	28	4	8	2	2		91
System optimization	10	6	9	13	23	5	5	5	76
Data mining and remote sensing	14	2	4	11		9	6	1	47
Fast approximate simulation	8	11	5	10	2	4		1	41
Predictive maintenance	7		3	5	5		2	2	24
Accelerated experimentation	1	2	3	2	3	1			12
Total	55	53	52	45	41	21	15	9	291

Heatmap illustrating the frequency of use of AI roles in different word analysis groups

Roles of AI

Forecasting: particularly prominent within clean energy and vegetation, where predictive insights support resource management and environmental monitoring

System optimization: widespread in clean energy, reflecting a focus on improving operational efficiency and performance

Data mining and remote sensing: notable for extracting actionable insights from unstructured data, especially in the health-care and remote-sensing groups, underscoring the growing need for data-driven decision-making

Accelerated experimentation and fast approximate simulation: specialized tools in clean energy and health care that facilitate research and preliminary analysis


SCISPACE
SciSpace Literature Review
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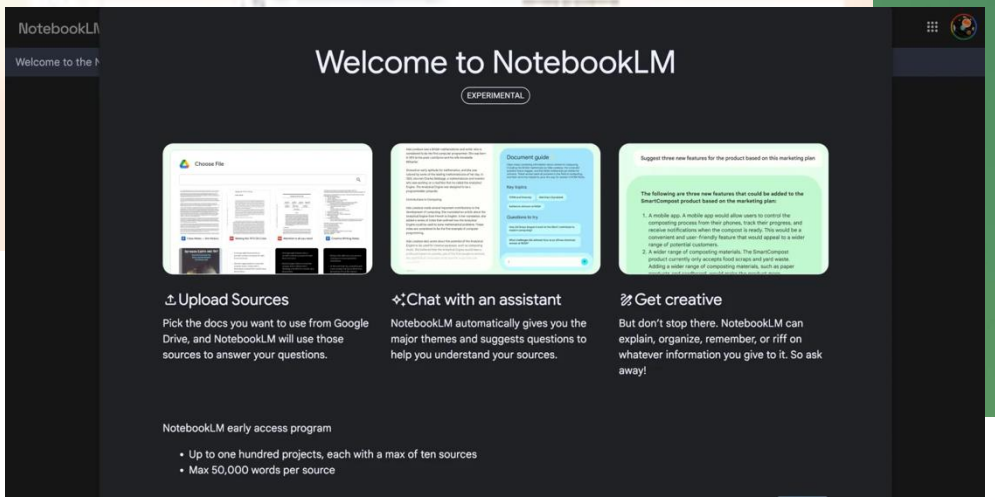
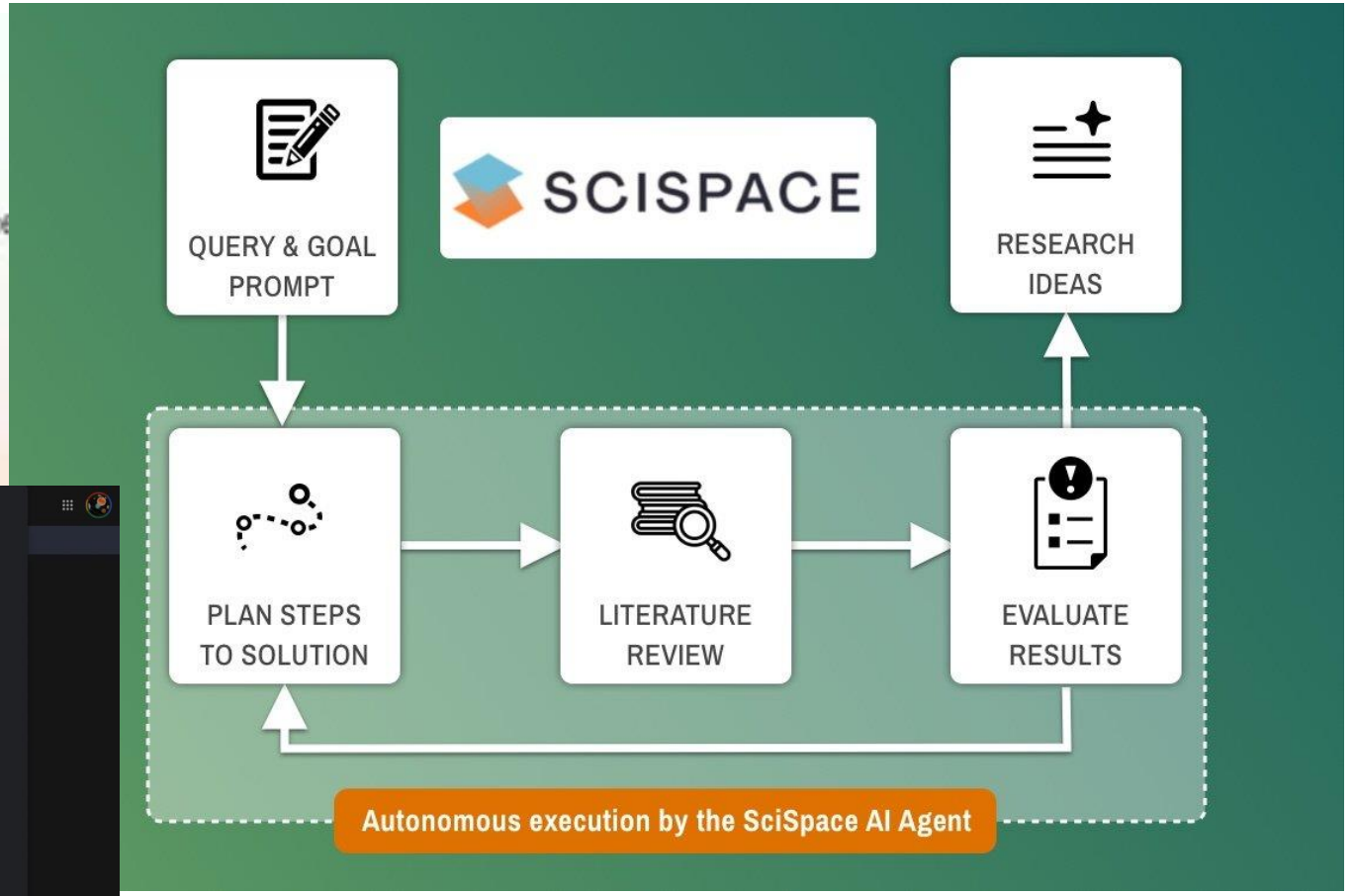
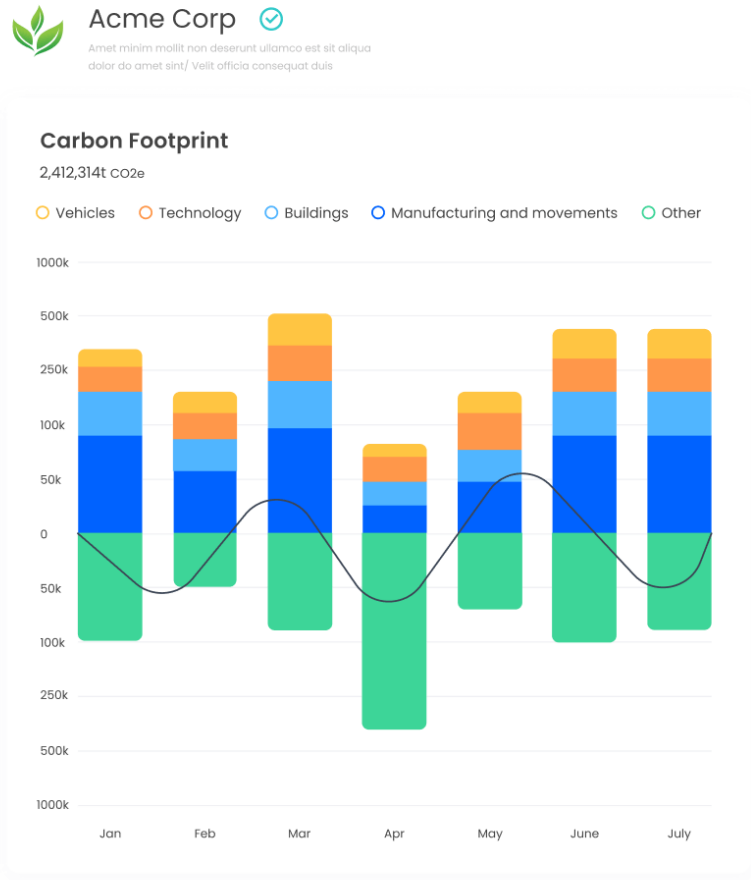
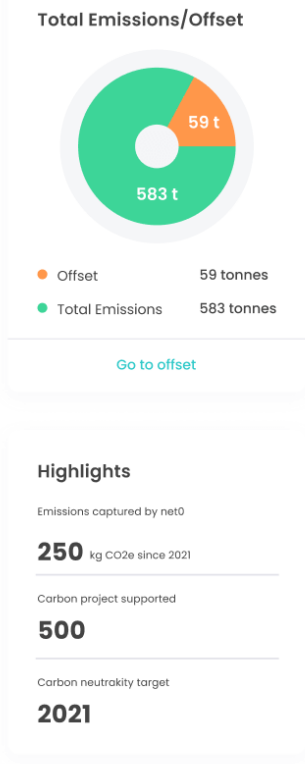

Welcome to NotebookLM
EXPERIMENTAL
Upload Sources
Pick the docs you want to use from Google Drive, and NotebookLM will use those sources to answer your questions.
Chat with an assistant
NotebookLM automatically gives you the major themes and suggests questions to help you understand your sources.
Get creative
But don't stop there. NotebookLM can explain, organize, remember, or riff on whatever information you give to it. So ask away!
NotebookLM early access program
• Up to one hundred projects, each with a max of ten sources
• Max 50,000 words per source


QUERY & GOAL PROMPT
SCISPACE
RESEARCH IDEAS
PLAN STEPS TO SOLUTION
LITERATURE REVIEW
EVALUATE RESULTS
Autonomous execution by the SciSpace AI Agent

Smarter University Operations: The Campus as a Living Laboratory

- AI monitors sustainability metrics in real time:
- Energy, water, waste, carbon footprint.
- Interactive dashboards turn data into learning opportunities.
- AI enhances procurement ethics and lifecycle analyses.
- NLP tools verify vendor sustainability claims.





When students can *see* the sustainability performance of their campus, education becomes experiential and accountability becomes cultural.

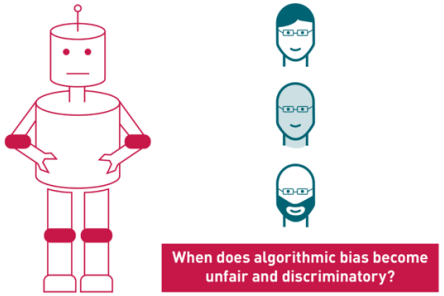
- https://play.vidyard.com/rCeF4nupHBnpU5BEqXfu7D?disable_popouts=1&type=inline&hidden_controls=0&hide_playlist=0&hide_html5_playlist=0&viral_sharing=0&name_overlay=0&autoplay=0&preload=metadata&v=4.3.15

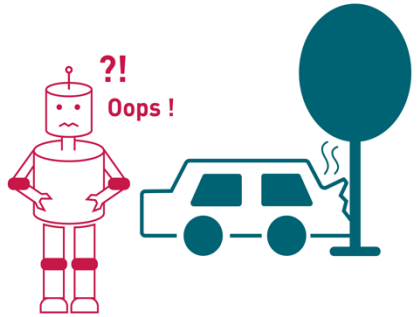
Reimagining the University’s Role

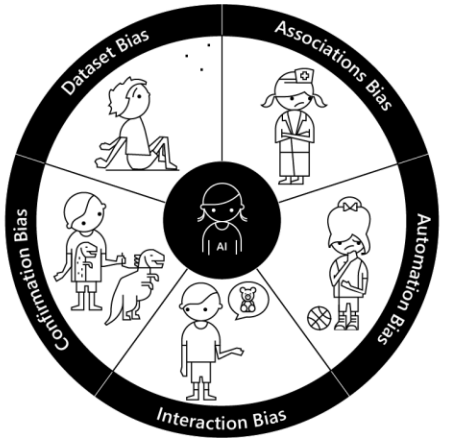
- Universities adopting AI amplifies impact across teaching, research, and engagement.
- Universities model sustainability through operations and ethics.
- Institutions become agents of transformation — not just education providers.
- The AI–ESD nexus invites us to reimagine the university itself — as a living ecosystem of sustainable innovation.

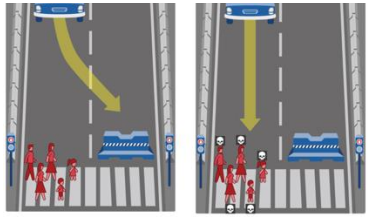
Smart Tech Requires Responsible Stewardship

- **Deepfake**: A fake video/image that looks real but has been digitally altered to mislead viewers.
- **Misinformation/Disinformation**: AI can sometimes generate convincing but untrue information or media, which can lead to the spread of misinformation or disinformation.
- **Hallucinations**: A "hallucination" happens when the A makes something up that isn't true but presents it as fact. Some mistakes might be minor, but others can have greater consequences.
- **Bias**: A GenAI tool uses the information and data it's trained on, which often includes patterns that favour certain groups or viewpoints. This can lead to results that reinforce harmful stereotypes, exclude certain groups, and produce non-inclusive language and images, resulting in discriminatory content.



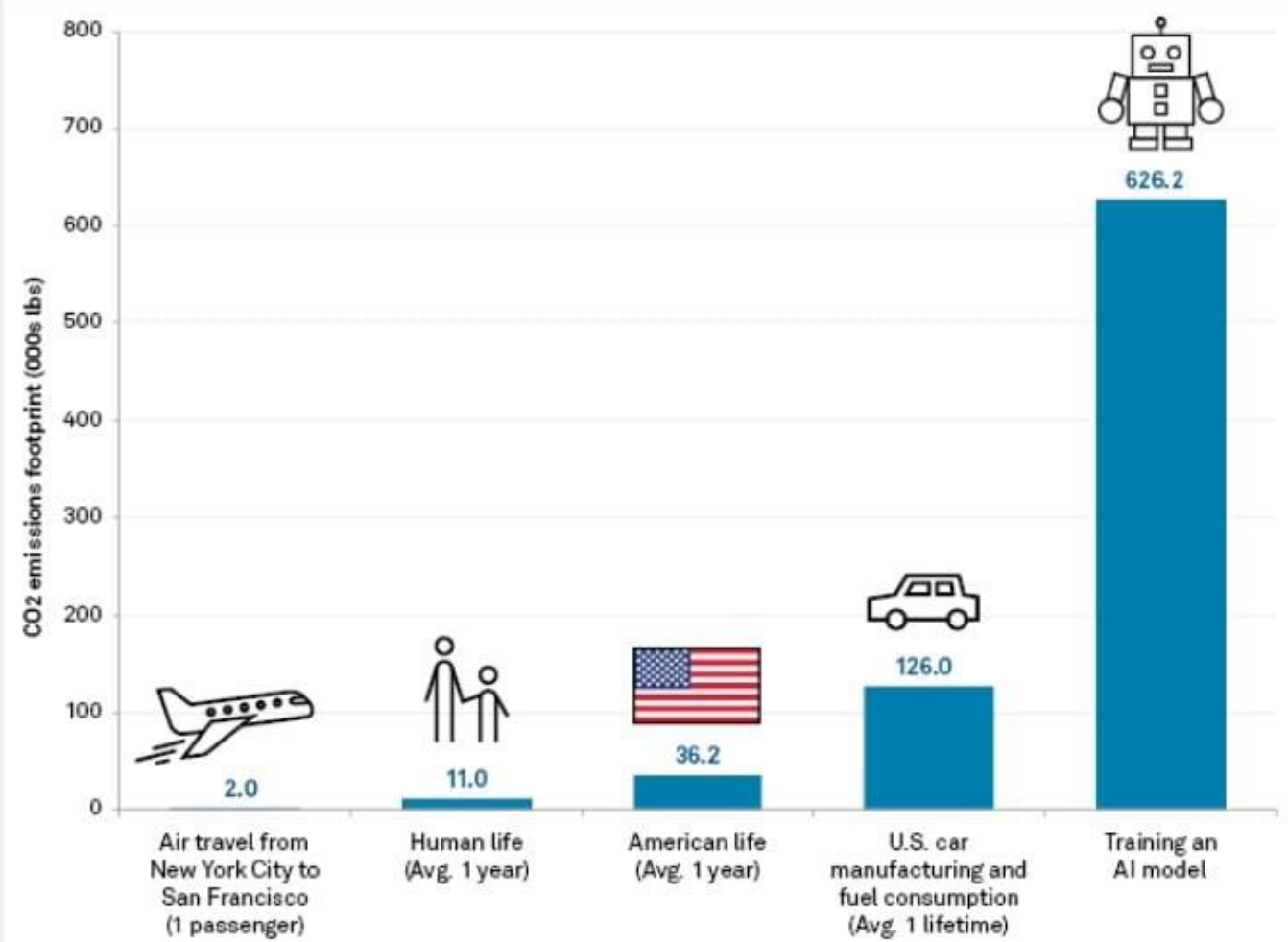







2+2=?
GPT
ChatGPT
says 2+2=22

CO2 emission benchmarks



Data compiled Oct. 9, 2019.
An "American life" has a larger carbon footprint than a "Human life" because the U.S. is widely regarded as one of the top carbon dioxide emitters in the world.
Source: College of Information and Computer Sciences at University of Massachusetts Amherst

- https://www.youtube.com/watch?v=b0C56yqIkbk

Towards Ethical and Equitable AI Adoption with Small Language Models (SLMs)

- On-premises / self-hosted AI models (e.g., DeepSeek, Llama) →

✓Reduce carbon footprint

✓Enhance data sovereignty

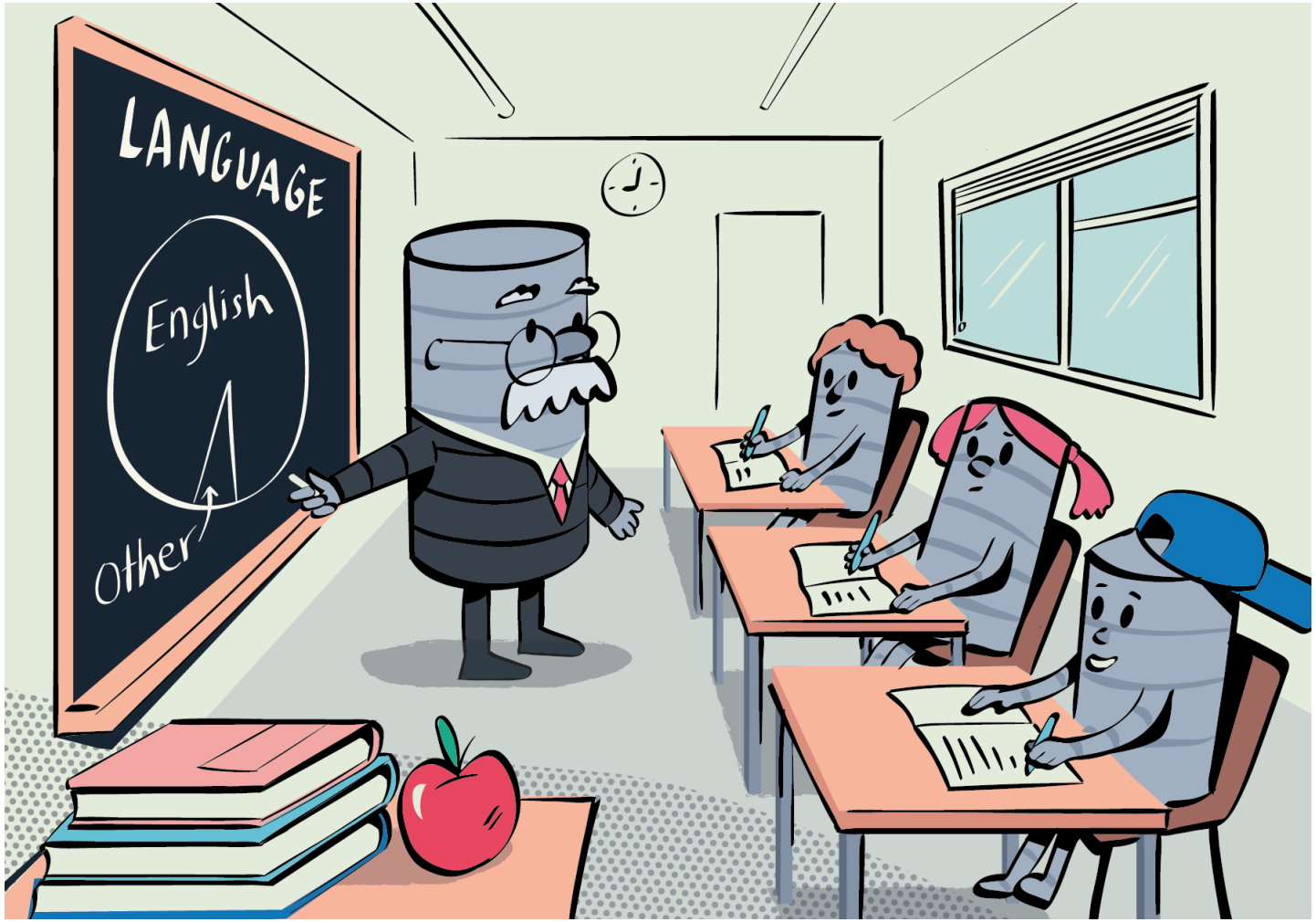
✓Allow contextual customisation for ESD goals

- Universities can lead by example — using smaller, locally hosted AI models that are greener, transparent, and globally shareable.

Be Careful with the New Digital Divide

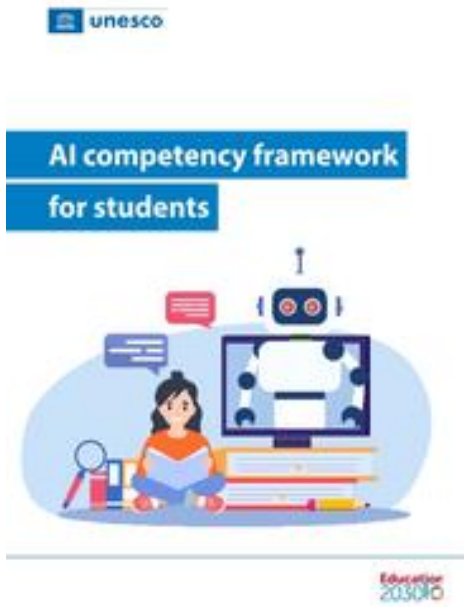
- The use of AI systems is not distributed uniformly across different countries, or even within regions in the same country.
- The varying levels of access and use of these technologies can reinforce and amplify already existing digital divides and data inequities.

Domination of English language data



- Concerted efforts are needed from all stakeholders (Government, Universities, Schools and Families)

UNESCO AI Competency Framework



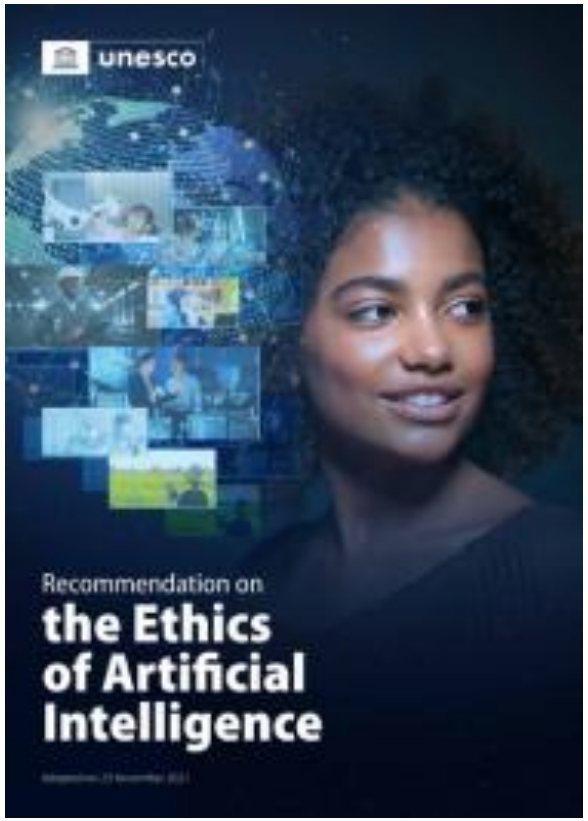
Aspects	Progression		
	Acquire	Deepen	Create
1. Human-centred Mindset	Human agency	Human accountability	AI social responsibility
2. Ethics of AI	Ethical principles	Safe and responsible use	Co-creating AI ethical rules
3. AI Foundations and Applications	Basic AI techniques and applications	Application skills	Creating with AI
4. AI Pedagogy	AI-assisted teaching	AI-pedagogy integration	AI-enhanced pedagogical transformation
5. AI for Professional Development	AI enabling lifelong professional learning	AI to enhance organizational learning	AI to support professional transformation

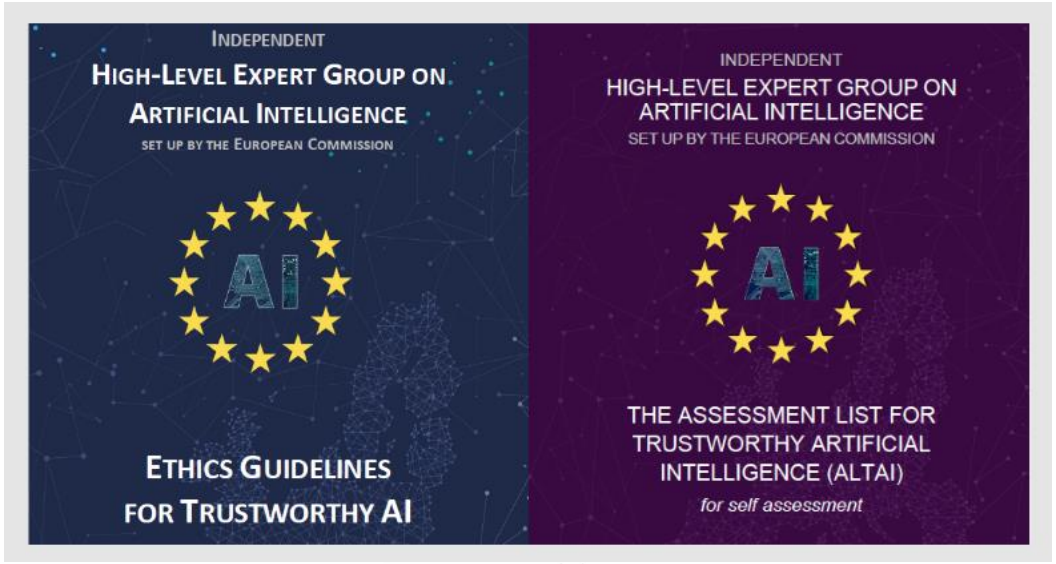
Table 1. AI competency framework for students

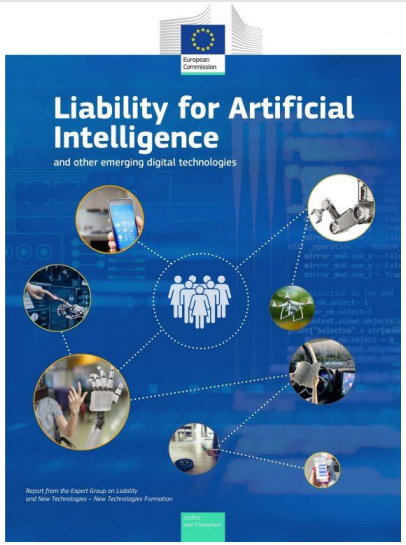
Competency aspects	Progression levels		
	Understand	Apply	Create
• Human-centred mindset	• Human agency	• Human accountability	• Citizenship in the era of AI
• Ethics of AI	• Embodied ethics	• Safe and responsible use	• Ethics by design
• AI techniques and applications	• AI foundations	• Application skills	• Creating AI tools
• AI system design	• Problem scoping	• Architecture design	• Iteration and feedback loops

Flinders University


unesco
Guidance for generative AI in education and research
Education 2030


unesco
Recommendation on
the Ethics of Artificial Intelligence


INDEPENDENT
HIGH-LEVEL EXPERT GROUP ON ARTIFICIAL INTELLIGENCE
SET UP BY THE EUROPEAN COMMISSION
AI
ETHICS GUIDELINES FOR TRUSTWORTHY AI
INDEPENDENT
HIGH-LEVEL EXPERT GROUP ON ARTIFICIAL INTELLIGENCE
SET UP BY THE EUROPEAN COMMISSION
AI
THE ASSESSMENT LIST FOR TRUSTWORTHY ARTIFICIAL INTELLIGENCE (ALTAI)
for self assessment


European Commission
Liability for Artificial Intelligence
and other emerging digital technologies

The Need for Clearer AI Policy at University Level

Teaching staffs have a key scaffolding role for students' effective, responsible use of AI for learning

Stay Informed!

- By exploring and piloting various AI tools within and beyond classrooms, we will gain a firsthand understanding of their capabilities and limitations for ESD.

- Community of Practices

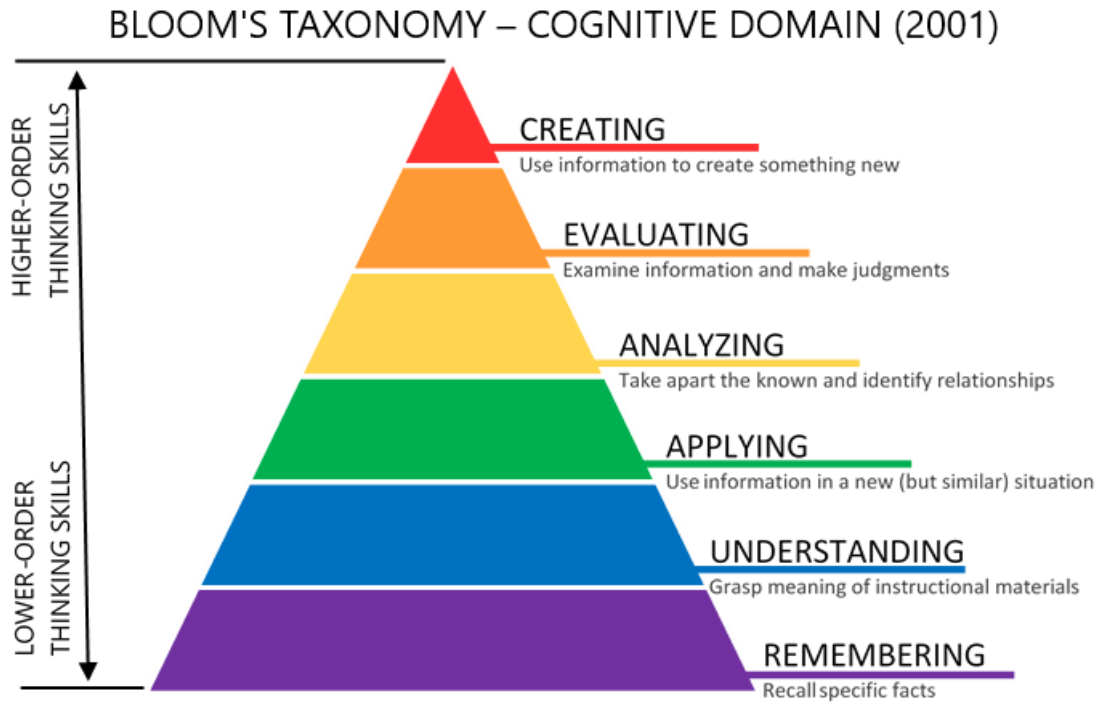
- Teacher AI Competency Upskilling

Encourage Critical Thinking

- Explain the importance of checking the credibility of a source before trusting the information

- Encourage the students to question AI-generated information and always ask, “Why?”

- If we want our students to be creative, critical thinkers, and problem solvers, it is crucial that education is delivered in ways that promote higher order thinking.
- Students need to experience the “aha!” moment – the moment of insight

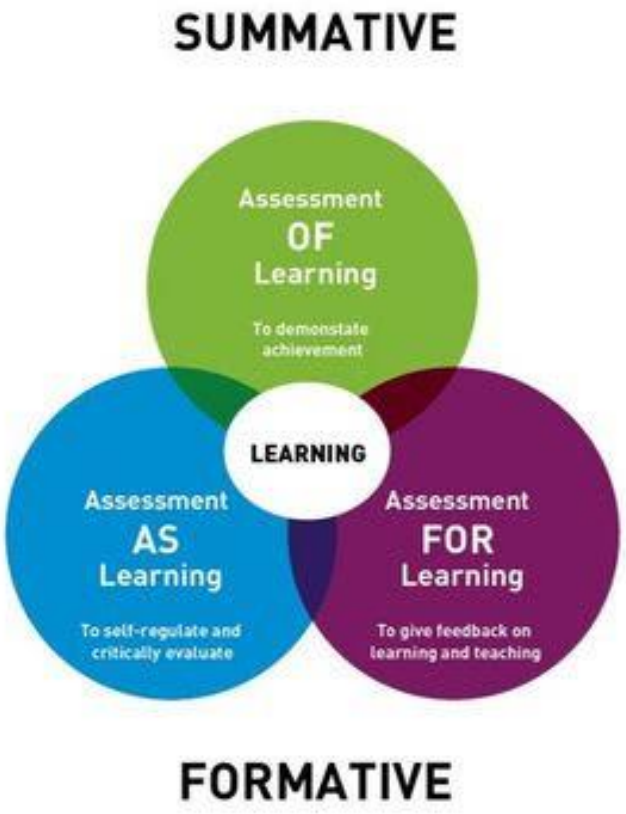


Krathwohl, D. R. (2002). A revision of Bloom's taxonomy: An overview. *Theory into practice*, *41*(4), 212-218.

Build competency-based, authentic assessments for ESD

- Iterative Projects
- Reflective Writing and Portfolios
- Oral Evaluations, Debates, and Interviews
- Process-Oriented Assessments
- Digital artefacts
- Adaptive Testing

……



Open Dialogue

- Discuss AI’s potential and limitations with colleagues and students, addressing both its benefits and risks.

- Share how they they might cautiously and responsibly use AI to be creative or get inspired.

Any Questions?

CONNECT

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