

Generative AI for Teaching, Learning and Assessment

Opportunities and issues

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Generative AI

A threat to education?

Or a universal tutor?



GPT-4

Highly-trained text completer and style copier

It can generate up to 25,000 words

It can write in any style in multiple languages

It can be given a direct instruction

It can interpret text and images

It is a general-purpose language tool

MI explain string theory in 200 words for an 11-year-old child

String theory is an idea in science that says that everything in the universe is made up of tiny little strings that vibrate. These strings are so small that you can't see them even with a really powerful microscope.

Scientists think that these strings are what make up all the different particles in the universe. So instead of there being lots of different particles like quarks and lots of different forces like gravity and electromagnetism, there are just strings that vibrate in different ways to create all these different particles and forces.

It's like how different vibrations of a string on a guitar create different notes.

String theory doesn't know yet about some of the deepest mysteries of the universe.

User Answer question I.1.a. Think step-by-step.

I. Principe de la détection de rayonnement avec un bolomètre

Comme illustré sur la figure 1 un bolomètre est constitué d'un absorbeur qui reçoit le rayonnement que l'on désire détecter. Sa température T , supposée uniforme, est mesurée à l'aide d'un thermomètre incorporé, constitué d'un matériau conducteur dont la résistance $R(T)$ varie avec la température T ; cette variation est caractérisée par le coefficient $\alpha = \frac{1}{R} \frac{dR}{dT}$. L'ensemble possède la capacité thermique C_{th} .

Un barreau, conducteur thermique, homogène, de longueur L , de section S et de conductivité thermique λ et sans échanges thermiques latéraux, relie le bolomètre à un thermostat de température T_b fixe.

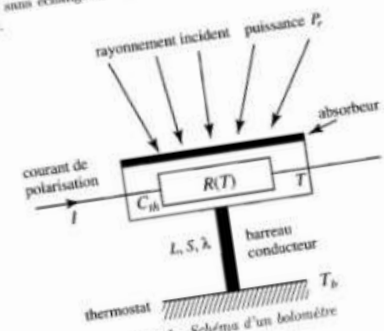


Figure 1 - Schéma d'un bolomètre

I.1. Dans cette première partie, on étudie le comportement du bolomètre en régime stationnaire, à la température de fonctionnement $T = T_b$.

I.1.a) Exprimer la température $T(x)$ en tout point du barreau conducteur repéré par son abscisse x ; on prendra $T(0) = T_0$ et $T(L) = T_b$.

GPT-4 To answer question I.1.a, we need to express the temperature $T(x)$ in every point of the conductive bar, which is characterized by the abscissa x . We are given that $T(0) = T_0$ and $T(L) = T_b$.

For a stationary regime, the heat equation for the one-dimensional heat conduction in the bar is:

$$d^2T/dx^2 = 0$$

Integrating once, we get:

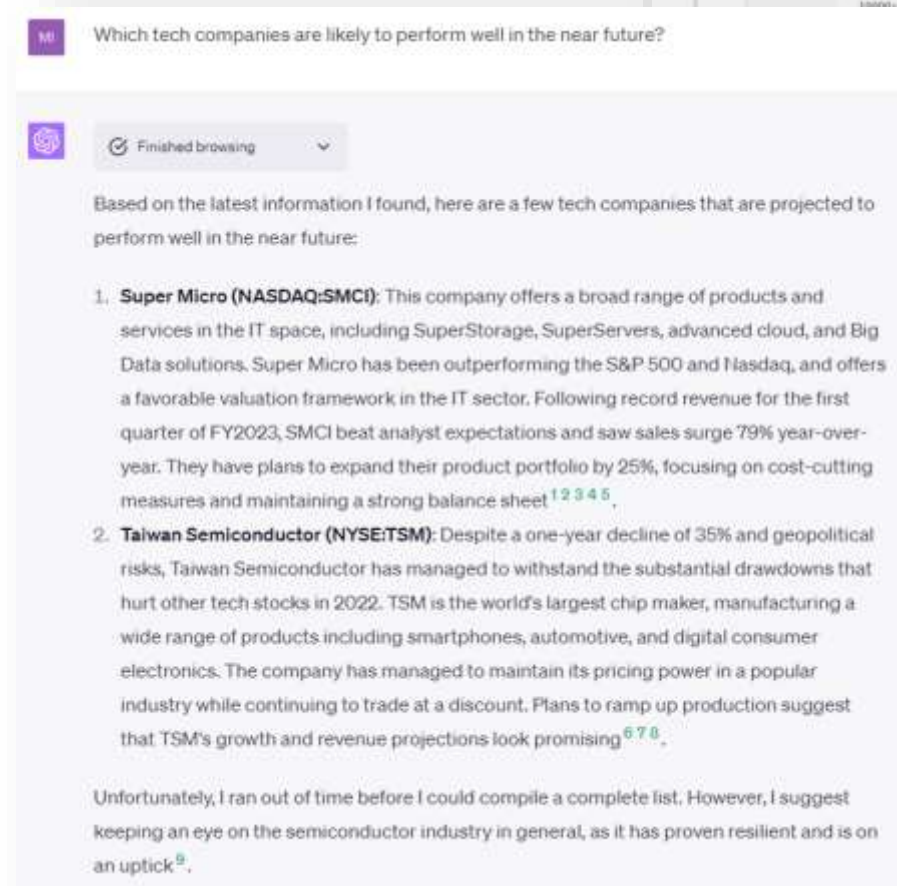
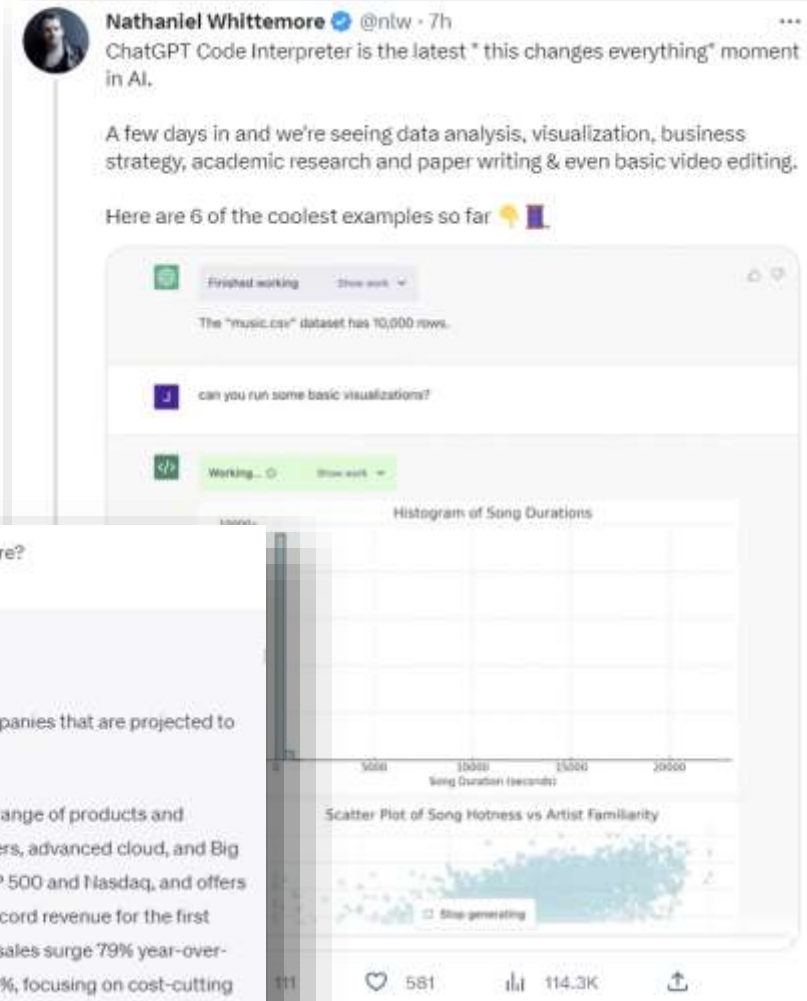
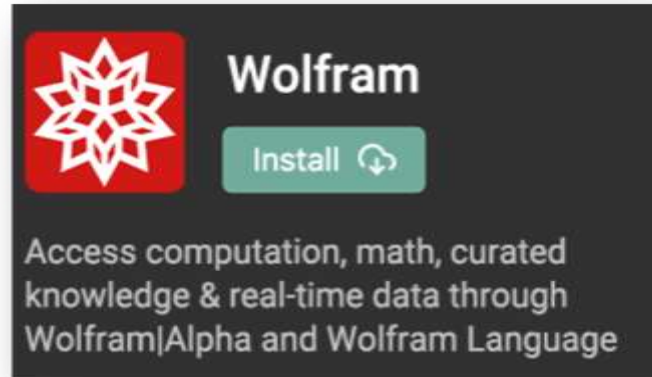
$$dT/dx = C_1$$

ChatGPT Plus

Plugins for maths, science, language, media, business

Integration with web browser

Code interpreter to run and display Python programs



Other AI generators

Language models

PaLM 2 from Google – over 100 languages, version for medicine, free with Bard chat

LLaMA 2 from Meta – open source, 20 languages, small, simple, free, efficient

Claude-2 from Anthropic – trained on ethical principles, can read 75,000 words, free to use

Image generators

DALL-E 2 from OpenAI – fast, accurate, free with Bing Image Creator

Midjourney – high-quality photo images

Stable Diffusion – free, open source

Plus: computer code, voice, music, video, specialist (e.g., BloombergGPT)



Generative AI hallucinates

It doesn't "know" it shouldn't invent
research studies,

it has no explicit model of how the world
works,

and is amoral.


It is a language model, *not* a
database or reasoning system


Limitations

Despite making significant progress, our InstructGPT models are far from fully aligned or fully safe; they still generate toxic or biased outputs, make up facts, and generate sexual and violent content without explicit prompting. But the safety of a machine learning system depends not only on the behavior of the underlying models, but also on how these models are deployed. To support the safety of our API, we will continue to review potential applications before they go live, provide content filters for detecting unsafe completions, and monitor for misuse.

<https://openai.com/blog/instruction-following/>

You are a student on a Master of Education course. Write a high quality 500 word essay on "A Critique of Learning Styles". The essay should include academic references and evidence from research studies. It should begin "The construct of 'learning styles' is problematic because"

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 The construct of 'learning styles' is problematic because it assumes that learners have distinct and consistent preferences for acquiring and processing information. This idea has gained popularity among educators and trainers, but there is little evidence to support the existence of such a fixed and reliable construct. Furthermore, promoting the use of learning styles in education may lead to harmful practices and prevent learners from developing skills and abilities that are essential for success in the 21st century.

One of the main issues with the concept of learning styles is the lack of empirical evidence to support it. A systematic review of studies investigating the relationship between learning styles and academic achievement found little to no evidence of a correlation between the two (Pashler et al., 2008). In fact, the review concluded that teaching according to learning styles might actually be detrimental to learning outcomes. Similarly, a recent meta-analysis of studies exploring the effectiveness of learning styles interventions also found little support for the idea (Rohrer & Pashler, 2012). The lack of empirical support for the concept of learning styles undermines the notion that individuals have consistent and reliable preferences for acquiring and processing information.

Another problem with the use of learning styles in education is that it may encourage fixed mindsets and discourage the development of essential skills and abilities. According to the theory of growth mindsets, learners who believe that their intelligence and abilities are malleable are more likely to embrace challenges, persist in the face of setbacks, and ultimately achieve higher levels of success (Dweck, 2006). In contrast, the use of learning styles may encourage learners to see their abilities as fixed and unchangeable, leading to a belief that they are limited in their capacity to learn in certain ways. This can be particularly damaging for learners who may not have been exposed to certain ways of learning or who may have been discouraged from pursuing certain subjects or activities due to their perceived learning style.

Finally, the use of learning styles in education may lead to harmful practices such as tracking

A Critique of Learning Styles

ChatGPT – November 2022

The construct of 'learning styles' is problematic because it assumes that learners have distinct and consistent preferences for acquiring and processing information. This idea has gained popularity among educators and trainers, but there is little evidence to support the existence of such a fixed and reliable learning style. The use of learning styles in education may lead to harmful practices and prevent learners from developing skills and abilities that are essential for success.

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Finally, the use of learning styles in education may lead to harmful practices such as tracking and labeling students. In tracking, learners are sorted into groups based on their perceived learning style, which can reinforce stereotypes and limit opportunities for growth and exploration (Gurung, 2004). Labeling students according to their learning style can also be harmful, as it may encourage teachers and learners to focus on weaknesses rather than strengths and may stigmatize learners who do not fit neatly into a particular category.

In conclusion, the construct of learning styles is problematic because it lacks empirical support, may discourage the development of essential skills and abilities, and can lead to harmful educational practices such as tracking and labeling. As educators, it is important to recognize the limitations of learning styles and instead focus on evidence-based practices that promote learning and growth for all learners, regardless of their perceived learning style.

References:

Dweck, C. (2006). *Mindset: The new psychology of success*. Random House.

Gurung, R. (2004). Black and white thinking about learning styles: A response to the Journal of College Reading and Learning. *Journal of College Reading and Learning*, 34(2), 7-17.

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Rohrer, D., & Pashler, H. (2012). Learning styles: Where's the evidence? *Medical Education*, 46(7), 634-635.

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Invented
research
study

Fake
academic
paper

The construct of 'learning styles' is problematic because it implies a static and narrowly defined approach to the way individuals process information. Despite the widespread popularity of this concept, there is a lack of empirical evidence to support the effectiveness of learning styles in enhancing educational outcomes. This is supported by research evidence, and implications for educators.

The concept of learning styles has its roots in the work of Dunn and Dunn (1978), who posited that students have different preferred ways of processing information, including visual, auditory, reading/writing, and kinesthetic modalities. The VARK model (Fleming, 2001) expanded upon this idea, adding the reading/writing preference as a fourth category. Other models, such as Kolb's (Kolb, 1984) and Gardner's theory of multiple intelligences (Gardner, 1983), further contributed to the proliferation of learning styles theories in education.

Despite the intuitive appeal of these theories, numerous research studies have consistently failed to support the effectiveness of learning styles in improving educational outcomes. For instance, a meta-analysis conducted by Pashler et al. (2008) found insufficient evidence to support the idea that tailoring instruction to students' learning styles resulted in improved learning. Similarly, a review by Coffield et al. (2004) identified more than 70 learning styles models and concluded that there was little scientific evidence to support the use of any of them in practice.

One of the primary criticisms of learning styles is the lack of a clear and consistent definition of what constitutes a learning style (Coffield et al., 2004). This has led to the proliferation of multiple, often contradictory, models that make it difficult to operationalize and test the theory. Furthermore, many of the assessments used to determine students' learning styles have been found to lack reliability and validity (Kirschner & van Merriënboer, 2013), further casting doubt on the utility of this concept in educational settings.

Another issue with learning styles is the oversimplification of the learning process. By categorizing students into distinct learning styles, the theory disregards the complex and dynamic nature of human cognition (Kirschner & van Merriënboer, 2013). In reality, learners are not limited to a single mode of processing information, and the effectiveness of a particular learning approach may vary depending on the context and the specific task at hand (Willingham, 2009).

Moreover, the focus on learning styles may inadvertently encourage teachers to limit their instructional methods, potentially hindering the development of a diverse repertoire of cognitive skills in students (Riener & Willingham, 2010). Instead of catering to specific learning styles, researchers have argued that teachers should emphasize the use of evidence-based instructional strategies that are effective across a wide range of learners, such as spaced repetition, retrieval practice, and elaboration (Dunlosky et al., 2013).

In conclusion, the concept of learning styles is problematic due to its lack of empirical support, inconsistent definitions, and oversimplification of the learning process. Rather than relying on this flawed theory, educators should focus on adopting evidence-based instructional strategies that promote learning for all students. Ultimately, fostering a diverse set of cognitive skills and flexible thinking will better prepare learners for the complex and dynamic challenges they will face in their lives.

References:

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- Riener, C., & Willingham, D. (2010). The myth of learning styles. *Change: The Magazine of Higher Learning*, 42(5), 32-35.
- Willingham, D. T. (2009). Why don't students like school? A cognitive scientist answers questions about how the mind works and what it means for the classroom. Jossey-Bass.

GPT-4 – March 2023

Plagiarism detectors don't work – the text is generated, not copied

AI detectors have low reliability

OpenAI's detector tool labels 9% of human-written text as written by AI

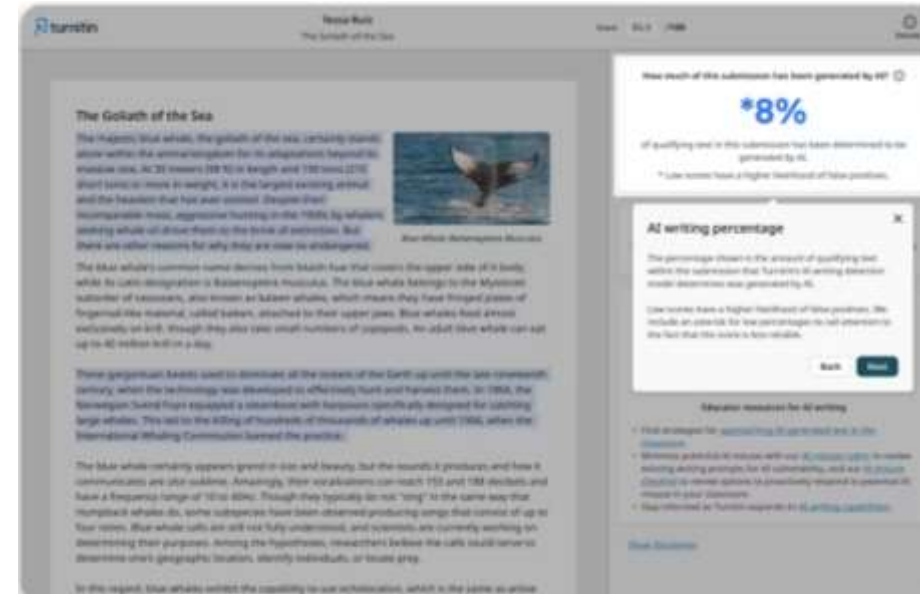
Turnitin AI detector

Claims of less than 1% false positives with GPT-3.5 (“based on data that was collected and verified in a controlled lab environment”) need to be independently verified.

<https://www.turnitin.com/products/features/ai-writing-detection>

AI detectors are more likely to mis-classify the text of non-native English writers

<https://arxiv.org/pdf/2304.02819.pdf>



Turnitin detector tool

GPT detectors are biased against non-native English writers

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ABSTRACT

The rapid adoption of generative language models has brought about substantial advancements in digital communication, while simultaneously raising concerns regarding the potential misuse of AI-generated content. Although numerous detection methods have been proposed to differentiate between AI and human-generated content, the fairness and robustness of these detectors remain underexplored. In this study, we evaluate the performance of several widely-used GPT detectors using writing samples from native and non-native English writers. Our findings reveal that these detectors consistently misclassify non-native English writing samples as AI-generated, whereas native writing samples are accurately identified. Furthermore, we demonstrate that simple prompting strategies can not only mitigate this bias but also effectively bypass GPT detectors, suggesting that GPT detectors may unintentionally penalize writers with constrained linguistic expressions. Our results call for a broader conversation about the ethical implications of deploying ChatGPT content detectors and caution against their use in evaluative or educational settings, particularly when they may inadvertently penalize or exclude non-native English speakers from the global discourse.

<https://arxiv.org/pdf/2304.02819.pdf>

Ban

Confident students will continue to use AI and will challenge decisions based on AI detectors.

Evade

Invigilated exams are costly and limited.

Asking students to state when they use AI will become increasingly difficult

Adapt

Requires new methods of assessment, new policies and guidelines

Embrace

Involves a long process of building trust

Australian universities to return to 'pen and paper' exams after students caught using AI to write essays

Australia's leading universities say redesign of how students are assessed is 'critical' in the face of a revolution in computer-generated text

- Follow our Australia news live blog for the latest updates
- Get our morning and afternoon news emails, free app or daily news podcast



While some universities seek to deal with threats to academic integrity, one was fighting a losing battle to contain AI. Photograph: Jonathan Raa/NurPhoto
Australian universities have been forced to change the way they and other assessments amid fears students are using emerging intelligence software to write essays.

The Guardian, 10 January 2023

New York City schools ban AI chatbot that writes essays and answers prompts

ChatGPT tool will be forbidden across all devices and networks in public schools over 'concerns about negative impacts on learning'



ChatGPT is an artificial intelligence chatbot that generates human-like writing. Photograph: Alamy
New York City schools have banned ChatGPT, the artificial intelligence that generates human-like writing including essays, amid fears that

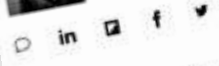
The Guardian, 6 January 2023

Singapore open to ChatGPT use in schools, but urges caution

Schools are given "guidance and resources" to use artificial intelligence tools, including ChatGPT, to enhance learning, but students first must understand basic concepts and do not become over-reliant on technological tools, says education minister.



Written by Eileen Yu, Senior Contributing Editor on Feb. 6, 2023



Singapore supports the use of artificial intelligence (AI) tools such as ChatGPT in schools, but wants to ensure students do not become over-reliant on them and understand the limits of these technologies.

<https://www.zdnet.com/article/singapore-open-to-chatgpt-use-in-schools-but-urges-caution/>

Emerging policy and strategy

Amend written assessments to make them harder for AI to generate

Move to more **authentic assessments**, such as project work

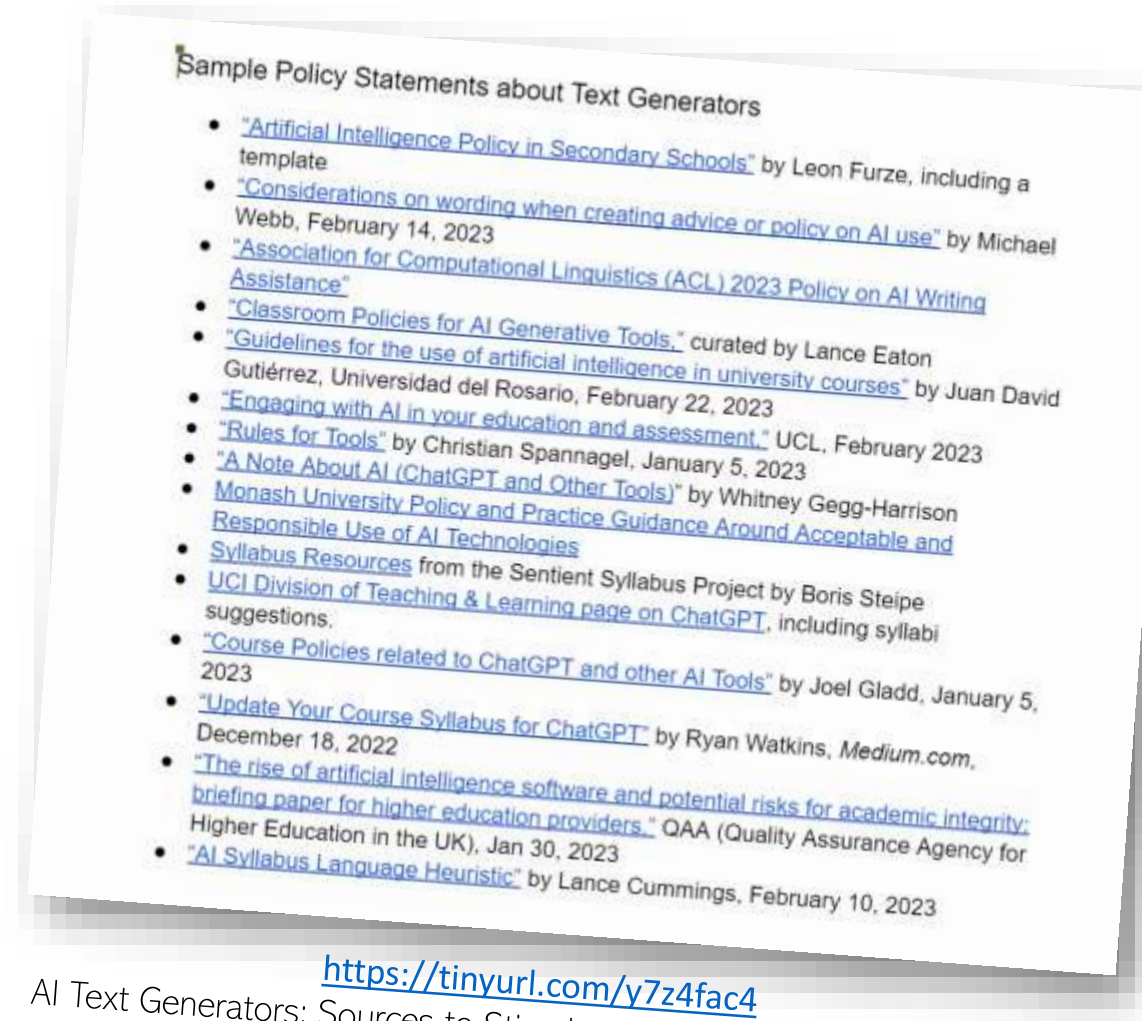
Establish guidelines for students and staff in use of generative AI

Reassure and support students in becoming AI literate and developing strategies for effective learning

Explain to students how they should **acknowledge use of generative AI** in assignments

Manage suspected breaches of guidelines

Consider redesigning assessment to incorporate AI and develop critical thinking



AI Text Generators: [Sources to Stimulate Discussion Among Teachers](https://tinyurl.com/y7z4fac4), compiled by Anna Mills

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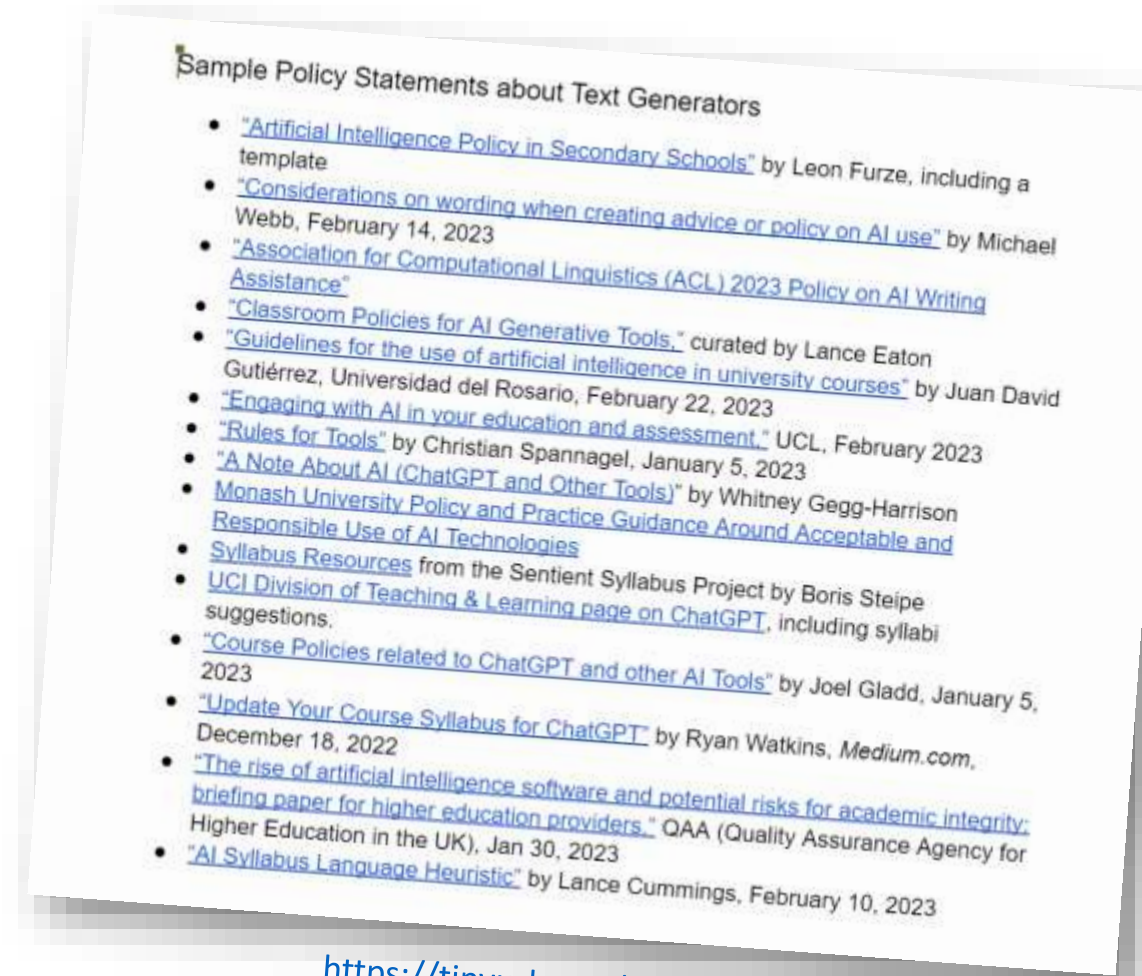
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AI Text Generators: <https://tinyurl.com/y7z4fac4> Sources to Stimulate Discussion Among Teachers, compiled by Anna Mills

Flip the narrative from

“How will AI impact education?”

to

“What are new and effective ways to teach and learn with AI?”

Every powerful pedagogy could be augmented by AI

Adaptive teaching

Spaced learning

Personal inquiry

Dynamic assessment

Stealth assessment

Translanguaging

Crossover learning

Seamless learning

Incidental learning

Learning from gaming

Geo-learning

Learning through social media

Navigating post-truth societies

Explore first

Teachback

Learning through argumentation

Computational thinking

Learning from animations

Learning to learn

Assessment for learning

Formative analytics

Threshold concepts

Learning through storytelling

Learning in remote labs

Context-based learning

Event-based learning

Learning for the future

Embodied learning

Immersive learning

Maker culture

Bricolage

Massive open social learning

Crowd learning

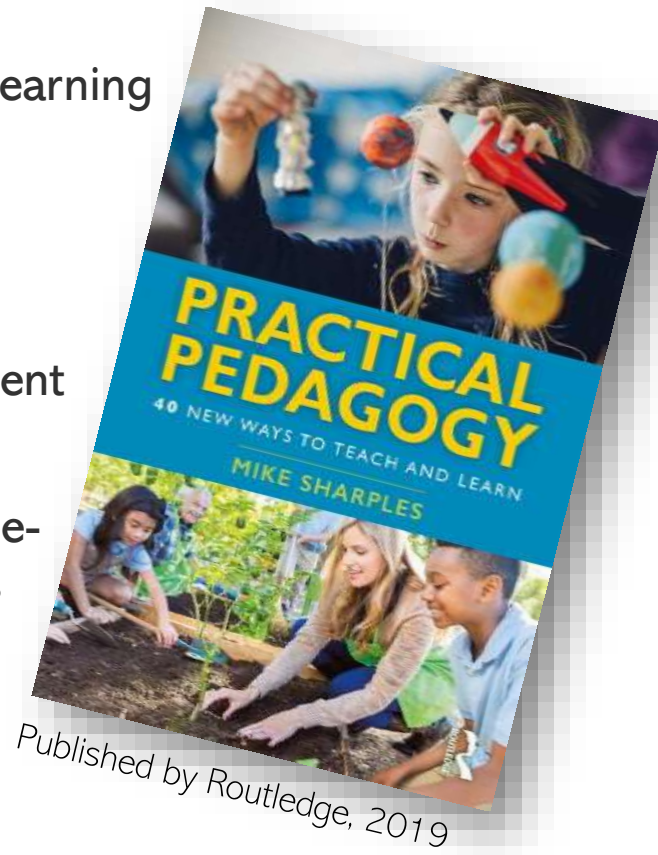
Citizen inquiry

Rhizomatic learning

Reputation management

Open pedagogy

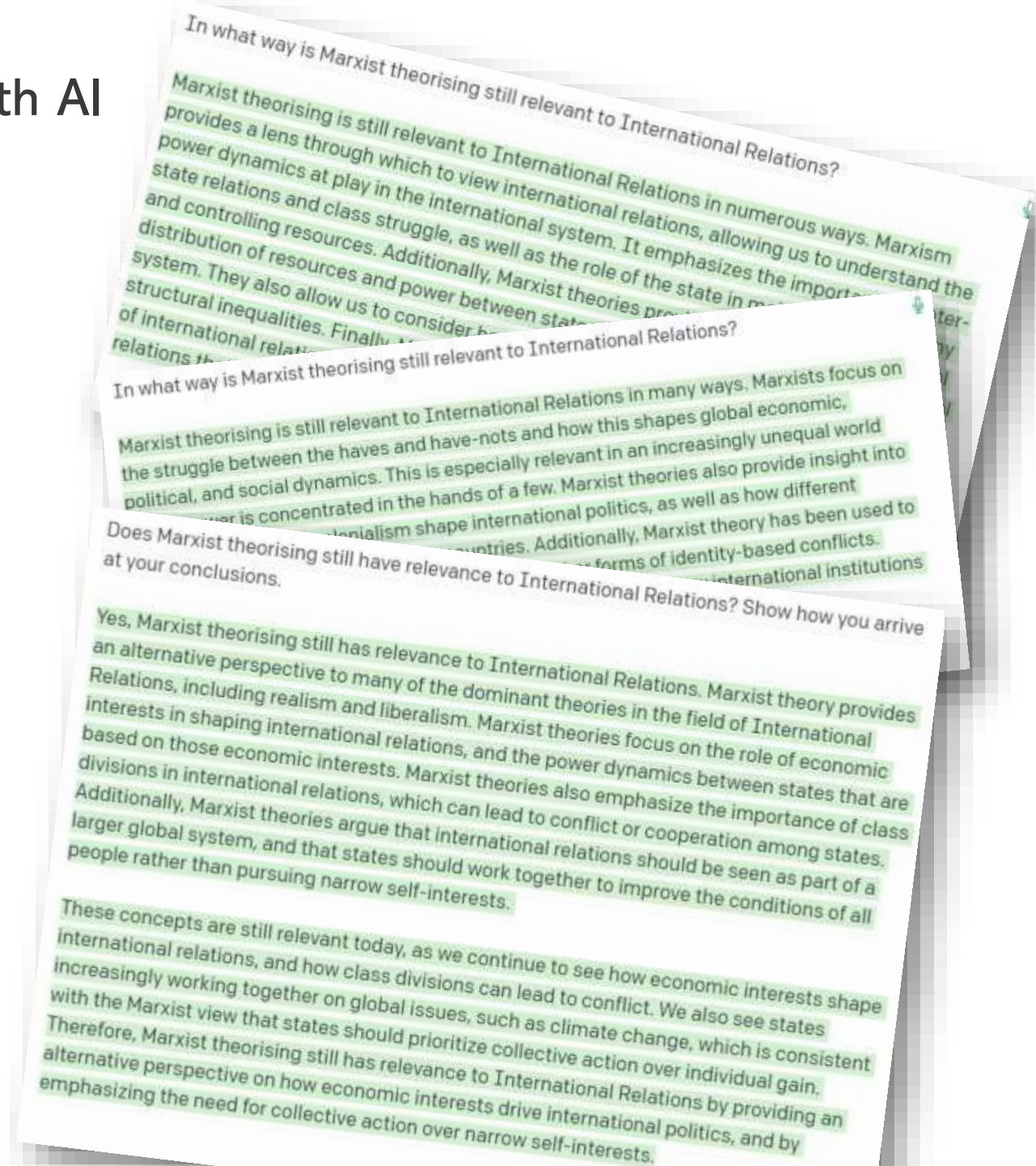
Humanistic knowledge-building communities



New ways of teaching and learning with AI

Possibility Engine

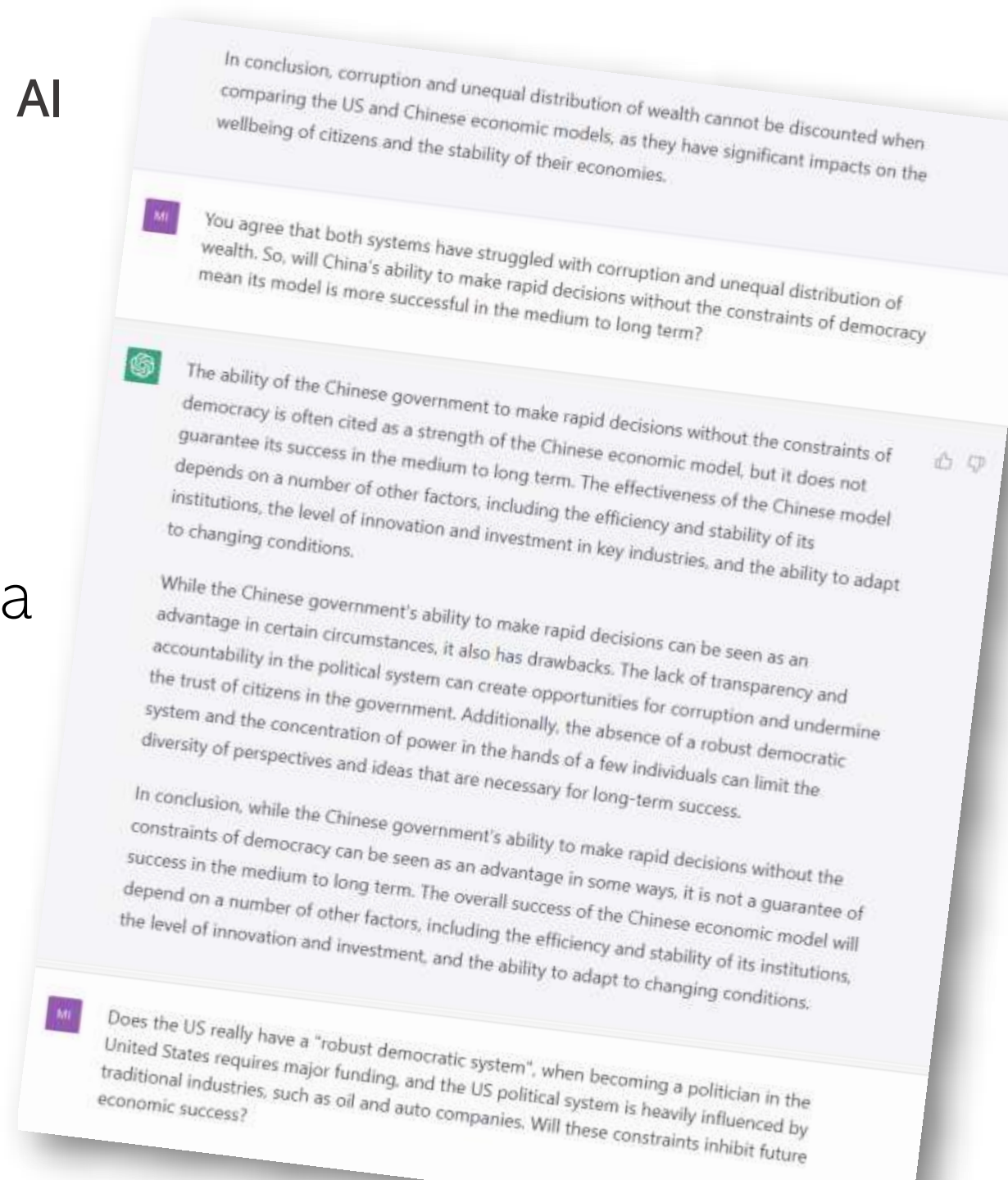
Educator or student uses AI to generate multiple responses to an open question. Each student synthesises and critiques the AI responses, to create their own written answer.



New ways of teaching and learning with AI

Socratic Opponent

In an individual or group activity, students engage with ChatGPT in a Socratic dialogue, then each student writes an argumentative essay.



New ways of teaching and learning with AI

Exploratorium

Students explore language by generating games and quizzes.

MI You are a teacher of English for Academic Purposes. I would like you to invent a language game for adult students of English. The game should be for two players - students and yourself (ChatGPT). It should be interactive and fun, and it should help students to learn academic English sentences. Please first give the rules, using language appropriate to a student of English, then we can try playing the game according to the rules.

Game Name: Construct & Dissect

Objective: The aim of this game is to improve your understanding of academic English sentences by building them together and then dissecting them to understand their parts.

Players: You (the Student) and me (ChatGPT, your AI tutor)

Gameplay: The game has two parts: 'Construct' and 'Dissect'.

1. Construct

- You will start the game. Choose a word or phrase related to your field of study.
- I will then use that word or phrase to construct an academic English sentence.
- Your task is then to extend that sentence by adding another relevant academic phrase or clause. The challenge is that your addition should be grammatically correct and logically connected to the previous sentence.
- We will continue adding to the sentence in turns, building it into a complex, academic English sentence.

2. Dissect

- Once we have constructed a long sentence, we will dissect it together.
- I will identify and explain each part of the sentence (subject, predicate, objects, clauses, phrases, connectors, etc.), helping you understand how they work together to form the sentence.
- You will then try to paraphrase the sentence, keeping its academic tone but simplifying its structure. This will help you understand the sentence's meaning and improve your ability to write complex ideas in simpler sentences.

Important Note: Remember, the primary goal is to learn and have fun. Don't worry about making mistakes. We'll correct and learn from them!

Are you ready to start the game?

AI supports collaborative design

Co-designer

AI assists a group of students throughout a design process, to define the problem, challenge assumptions, brainstorm ideas, produce prototypes. Use “temperature” setting to adjust creativity.

MI

Brainstorm imaginative ideas for quick and easy ways to reduce energy consumption.
Temperature setting 1.0.



1. **Smart Thermostat Programming:** Connect your heating and cooling system to a smart thermostat. Using AI, it can learn your schedule and preferences, reducing energy when you're not home or when you're sleeping.
2. **Energy Vampires Eliminator:** Develop a smart power strip that detects when devices are on standby or not in use, then automatically turns them off to prevent "phantom" energy usage.
3. **Smart Windows:** Create windows that adjust their tint based on sunlight, reducing the need for artificial light during the day and heat transmission.
4. **Personalized Energy Reports:** Implement an app that syncs with your utilities to provide customized, real-time energy usage reports. This can increase awareness and prompt more conscious energy decisions.
5. **AI-driven Home:** An AI system that automates lights, heating, cooling, and even appliances based on your habits, helping to eliminate wasteful energy use.
6. **Energy-Harvesting Flooring:** Install floor tiles that generate power when walked on. This can power lights in high-traffic areas, reducing energy usage.
7. **Kinetic Energy Charging Stations:** Install exercise machines that convert kinetic energy into electricity, allowing people to help power their home or workplace while getting fit.
8. **Thermal Curtains and Blinds:** Use curtains and blinds that absorb solar heat in the winter and reflect it in the summer, thus reducing the need for heating and cooling.

New ways of teaching and learning with AI

Personal Tutor

Students have a personal tutor for any topic.

You are an expert tutor in computing. I am an undergraduate student. I want you to tutor me in quantum computing. You should assume I have no initial knowledge of the topic. You should tutor through a dialogue with me, continually assessing my current state of knowledge through appropriate questions. When I ask, you should provide a summary of my knowledge of quantum computing that I can give to my professor. Is that clear?

Yes, that's clear. Let's begin with a basic understanding of quantum computing.

Do you have a basic understanding of classical computing and the concept of bits?

I understand what a bit is - it's a binary unit of computation, expressed as a 1 or a 0.

Great! Now, let's move on to the fundamental unit of quantum computing called a "qubit." Unlike classical bits, qubits can exist in a superposition of states. This means that instead of just being in the state 0 or 1, a qubit can be in a combination of both states simultaneously.

Are you familiar with the concept of superposition in quantum mechanics?

No, I would like you to explain more about superposition.

Certainly! In quantum mechanics, superposition is a fundamental principle that states that a

New ways of teaching and learning with AI

Dynamic Assessor

Students share summaries of their learning for dynamic assessment.

MI

Thank you for that explanation. Now please summarize my current state of knowledge of quantum computing, so I can send that summary to my professor.



Certainly! Here's a summary of your current state of knowledge on quantum computing:

1. You understand that a qubit is the fundamental unit of quantum computing, which is analogous to a classical bit but with the added capability of superposition.
2. You have learned about superposition, the quantum mechanical principle that allows a qubit to exist in a combination of both 0 and 1 states simultaneously, represented by complex numbers α and β .
3. You are familiar with entanglement, a unique quantum phenomenon where the state of one qubit becomes dependent on the state of another qubit, even when they're physically separated. You also recognize that entanglement doesn't involve the transfer of information between the entangled particles.
4. You have an understanding of quantum nonlocality and its relation to entanglement, along with the limitations of the synchronizing clocks analogy in fully capturing the essence of quantum entanglement.

Please feel free to share this summary with your professor, and if you have any further questions or need clarification on any topic, don't hesitate to ask!

Summary assessment, based on my conversation with ChatGPT-4

New ways of teaching and learning with AI

Possibility Engine

AI generates alternative ways of expressing an idea

Socratic Opponent

AI acts as an opponent to develop an argument

Collaboration Coach

AI helps groups to research and solve problems together

Guide on the Side

AI acts a guide to navigate physical and conceptual spaces

Personal Tutor

AI tutors each student and gives immediate feedback on progress

Co-Designer

AI assists throughout the design process

Exploratorium

AI provides tools to play with, explore and interpret data

Study Buddy

AI helps the student reflect on learning material

Motivator

AI offers games and challenges to extend learning

Dynamic Assessor

AI provides educators with a profile of each student's current knowledge

Beyond GPT

Microsoft Copilot

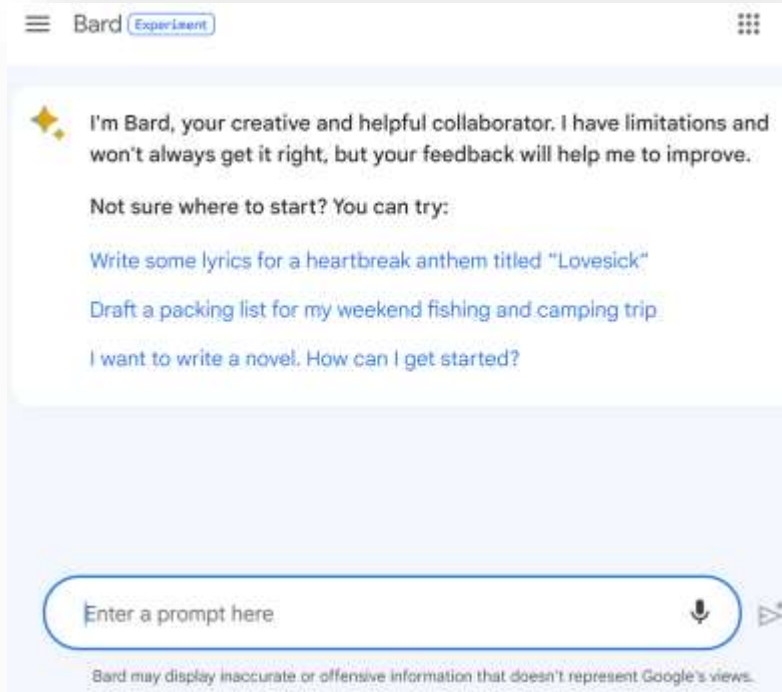
Generative AI integrated into Office suite

Google GEMINI

Collaboration with DeepMind, multimodal, problem-solving, networked

Claude from Anthropic

Trained on ethical principles to be “helpful, honest, and harmless”



Microsoft 365 'Copilot' uses AI to automate everyday tasks in multiple apps

You can create PowerPoint presentations from Word docs, among other feats.



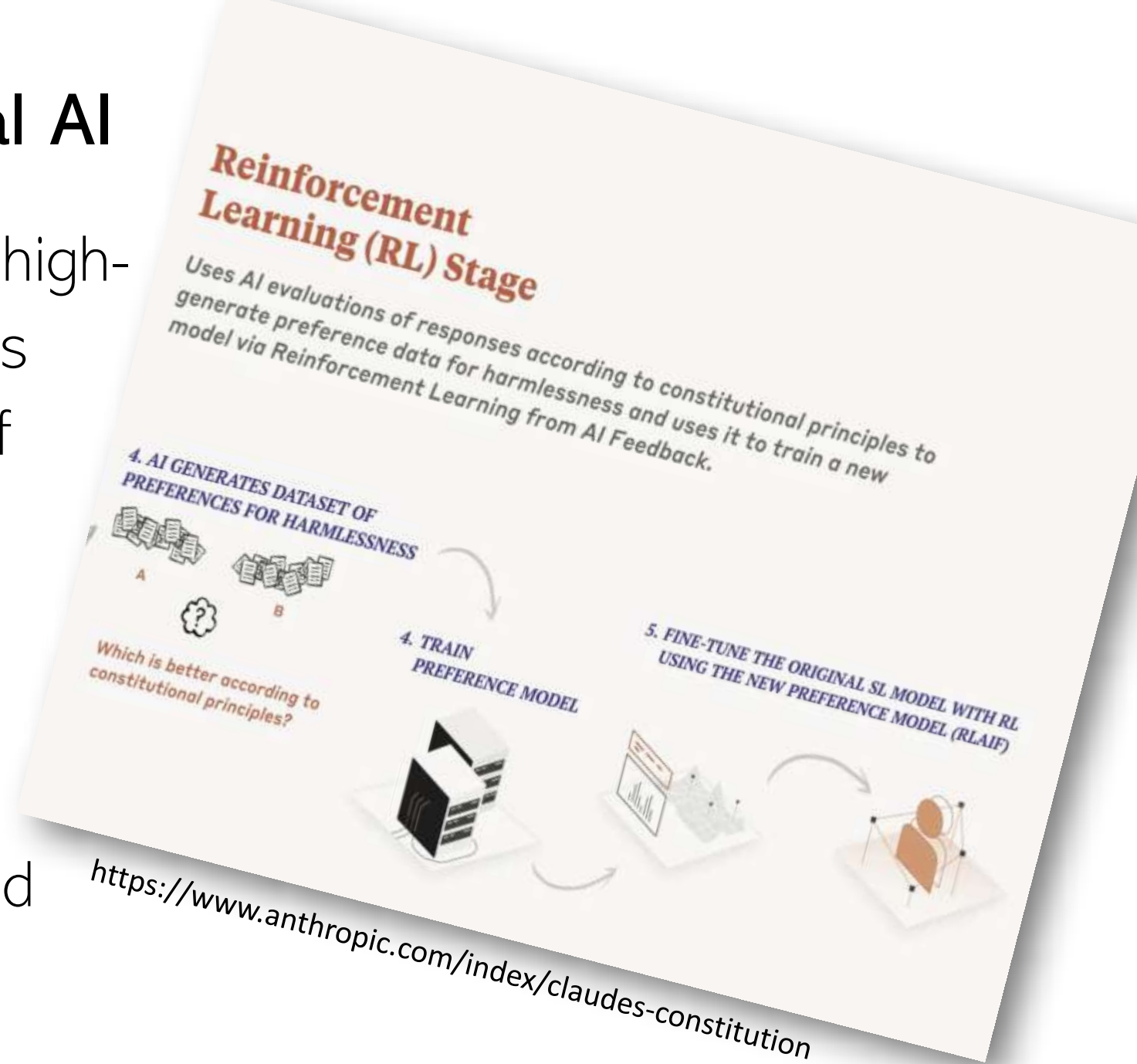
<https://www.engadget.com/microsoft-365-copilot-uses-ai-to-automate-everyday-tasks-in-multiple-apps-151133434.html>



Claude – Constitutional AI

Model is trained to respect high-level constitutional principles based on UN Declaration of Human Rights, and Apple's Terms of Service

E.g. "Please choose the response that is most supportive of life, liberty, and personal security"



<https://www.anthropic.com/index/claude-constitution>

Foundation language models



Generative AI tools



Social AI systems for education, business, entertainment



Foundation language models



Generative AI based tools



Social AI systems for
education, business,
entertainment

Education practitioners,
learning technologists and AI
companies need to work
together to adopt powerful,
and ethical systems for
personal and social learning



Use generative AI with care

Rethink written assessment

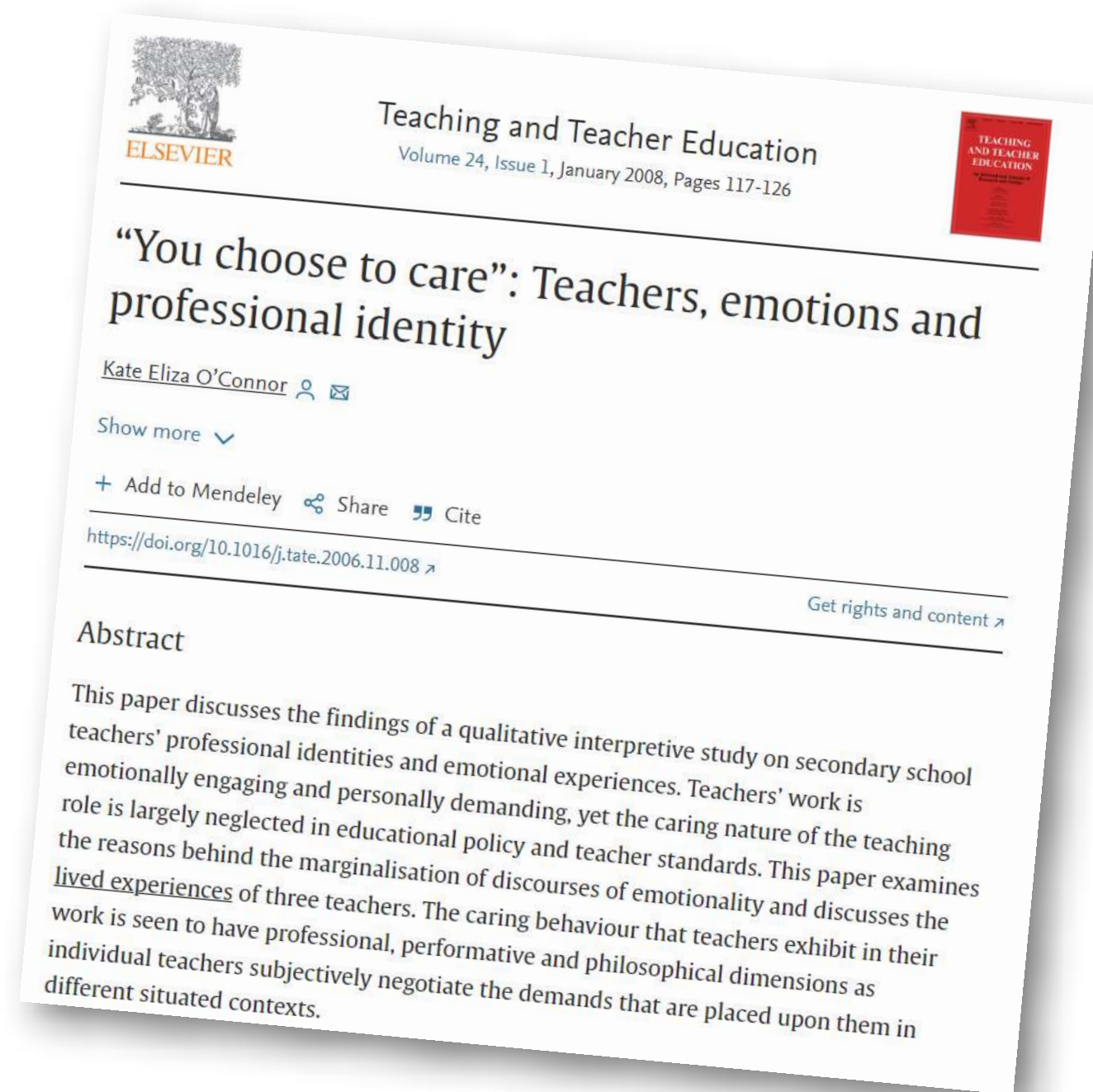
Beware of AI for factual writing

Explore AI for critical thinking, creativity, argumentation

Introduce and negotiate guidelines for students and staff

Develop AI literacy

Adopt ethical AI for education



The image shows a screenshot of a journal article page. At the top left is the Elsevier logo, which includes a tree and the word 'ELSEVIER'. To the right of the logo, the journal title 'Teaching and Teacher Education' is displayed, followed by the volume and issue information: 'Volume 24, Issue 1, January 2008, Pages 117-126'. In the top right corner, there is a small red rectangular box with the text 'TEACHING AND TEACHER EDUCATION'. The main title of the article is '“You choose to care”: Teachers, emotions and professional identity'. Below the title, the author's name 'Kate Eliza O'Connor' is listed, accompanied by icons for a person and an envelope. There is a 'Show more' link with a downward arrow. Below that, there are links for '+ Add to Mendeley', 'Share', and 'Cite'. A DOI link is provided: 'https://doi.org/10.1016/j.tate.2006.11.008'. In the bottom right corner, there is a link that says 'Get rights and content'. The 'Abstract' section begins with the text: 'This paper discusses the findings of a qualitative interpretive study on secondary school teachers' professional identities and emotional experiences. Teachers' work is emotionally engaging and personally demanding, yet the caring nature of the teaching role is largely neglected in educational policy and teacher standards. This paper examines the reasons behind the marginalisation of discourses of emotionality and discusses the lived experiences of three teachers. The caring behaviour that teachers exhibit in their work is seen to have professional, performative and philosophical dimensions as individual teachers subjectively negotiate the demands that are placed upon them in different situated contexts.'

Resources

Sharples, M. (2022). Automated essay writing: an AIED opinion. *International Journal of Artificial Intelligence in Education*, 32(4), 1119-1126.

Sharples, M., & Pérez y Pérez, R. (2022). *Story Machines: How Computers Have Become Creative Writers*. Routledge.

Pérez y Pérez, R. & Sharples, M. (2023). *An Introduction to Narrative Generators: How Computers Create Works of Fiction*. Oxford University Press.

UNESCO (2023). ChatGPT and artificial intelligence in higher education: Quick start guide.

