



THE LONDON SCHOOL
OF ECONOMICS AND
POLITICAL SCIENCE ■



Generative AI in education: catalyst or constraint?

INSIGHTS FROM GENIAL TO INFORM HIGHER EDUCATION POLICY

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Beveridge 2.0: AI and Data Science for Public Policy Symposium

08 May 2024





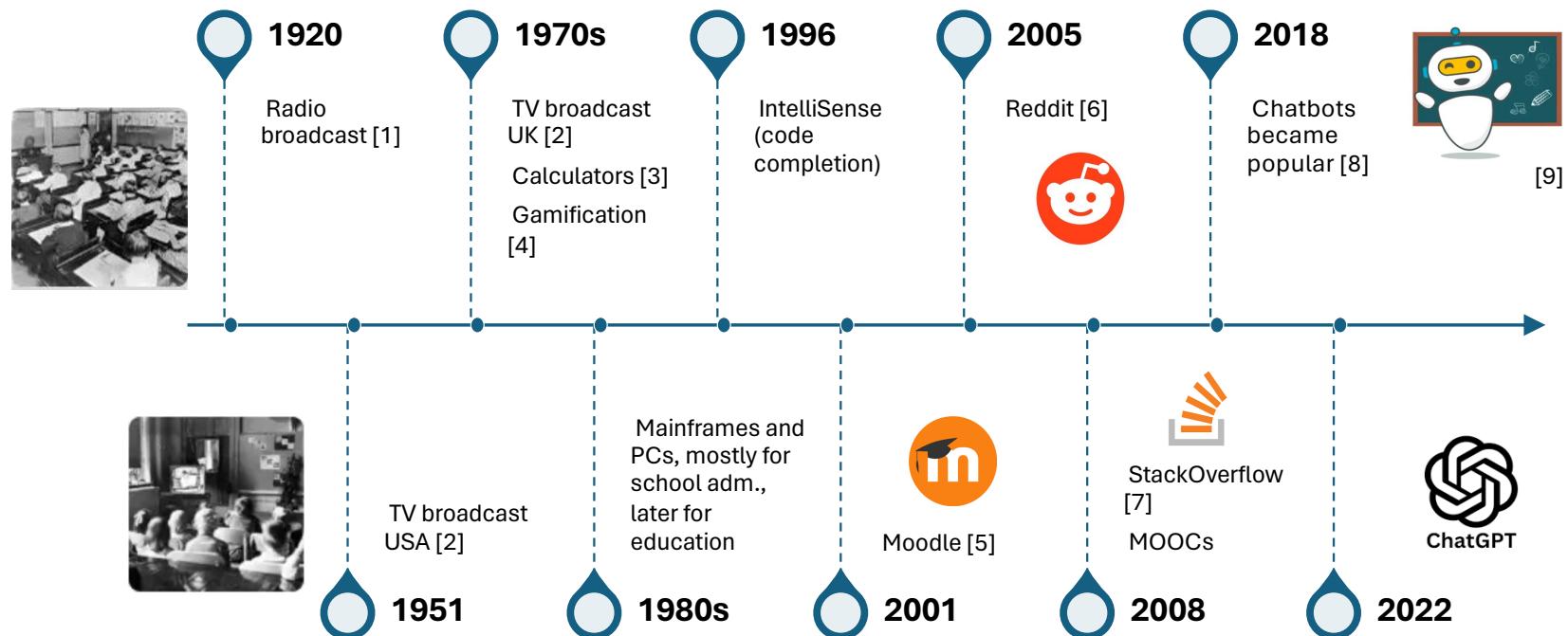
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■ **Outline**

- Technology (including AI) in education
- GENIAL project and selected results
- Existing policies and guidelines on AI in Education
- Our "suggestions"

■ Educational technology

- How were they adopted?
- What policies and guidelines were/are in place?



■ AI in education

■ Why is it different now?



Generative AI
harms vs capabilities

Skyrocket adoption

ChatGPT Sprints to One Million Users

Time it took for selected online services to reach one million users



* one million backers ** one million nights booked *** one million downloads

Source: Company announcements via Business Insider/LinkedIn



■ Opportunities and challenges

| Area | Opportunities | Concerns |
|------------------------|---|---|
| Social Sciences | <ul style="list-style-type: none"> Text summarisation, paper outline, brainstorming, edit feedback Improve metacognitive strategies | <ul style="list-style-type: none"> Loss of writing as a method and blurry of authorship Biased citations Shortcuts vs limited ability of instructors to verify original work |
| STEM | <ul style="list-style-type: none"> Synthesise code for data analysis / visualisation Dialogue with LLMs about specific topics + self-assessment of the learning process | <ul style="list-style-type: none"> Overconfidence Shortcut learning objectives |
| Programming | <ul style="list-style-type: none"> Simplify complex code structure Encourage best practices for software engineering Democratisation of programming | <ul style="list-style-type: none"> Expected programming skills vs motivation to learn Ability to navigate human+AI code bases Underspecification of assignments to outwit models |





GENIAL: GENerative AI Tools as a Catalyst for Learning

A Collaborative Focus Group

<https://lse-dsi.github.io/genial/>



- Focus group to understand students' experience and perception on using generative AI tools in their learning process.
- Collaborative project: Statistics, Data Science Institute, Management, and School of Public Policy.
- Timeline: July 2023 – April 2024
- Funding: Eden Centre
- Team:



Up: Francesca, Ghita, Ananya (picture), Leonard (picture)

Bottom: Sara, Dorottya, Jonathan, Casey, Marcos and Maxwell



GENIAL: GENerative AI Tools as a Catalyst for Learning

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- Case studies:

| Case study | Autumn Term (2023) | Winter Term (2024) |
|------------------------------|--|--|
| Undergraduate courses | <ul style="list-style-type: none">• DS105 – Data for Data Science• DS202 – Data Science for Social Scientists• ST207 – Databases | <ul style="list-style-type: none">• DS105 – Data for Data Science• DS202 – Data Science for Social Scientists• MG317 – Leading Organisational Change |
| Postgraduate courses | | <ul style="list-style-type: none">• ST456 – Deep Learning• PP422 – Data Science for Public Policy• MG4B7 – Leading Organisational Change |

Cohorts: 48 students

/

159 students



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■ Methodology & data collection

Autumn Term

- Initial survey on students' expectations / experience
- Focus on the use of AI in the classroom. Seminars had two moments:
 - no AI
 - "potential" use of AI
- Weekly survey at the end of the seminar
- AIs:
 - ChatGPT (3.5 only) and
 - GitHub Copilot
- Students submitted chat logs and screenshots on certain days.
- Final survey

Winter Term

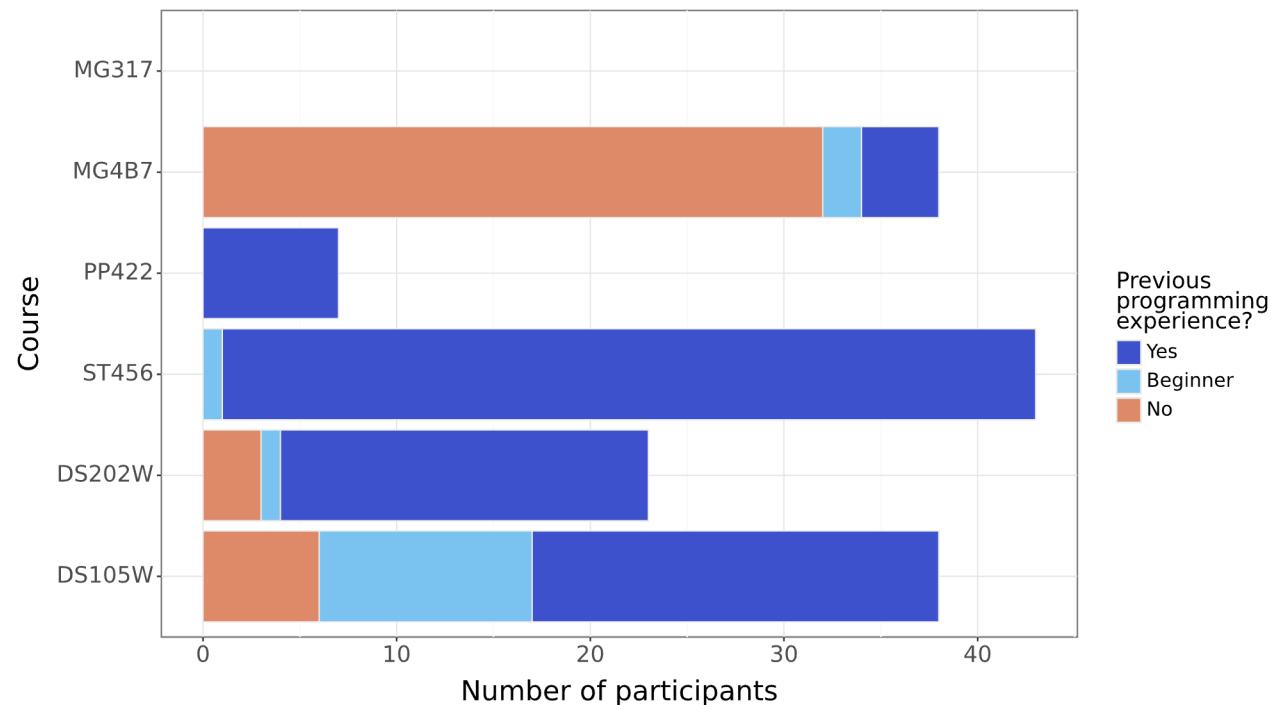
- Initial survey on students' expectations / experience
- **Students use AI chatbots whenever they want (lectures, classes, even assignments*)**
 - No prompt engineering (W01-W05);
 - some guidance when appropriate (W07 onwards)
- Weekly survey **now captures chat logs**
- AIs:
 - ChatGPT (3.5 and eventually 4.0) and
 - Google Bard/Gemini
- Focus group sessions
- Open Lecture
- Final survey

GENIAL initial survey results: the student experience



Most students reported having already done some programming

25% of students reported having no previous programming experience



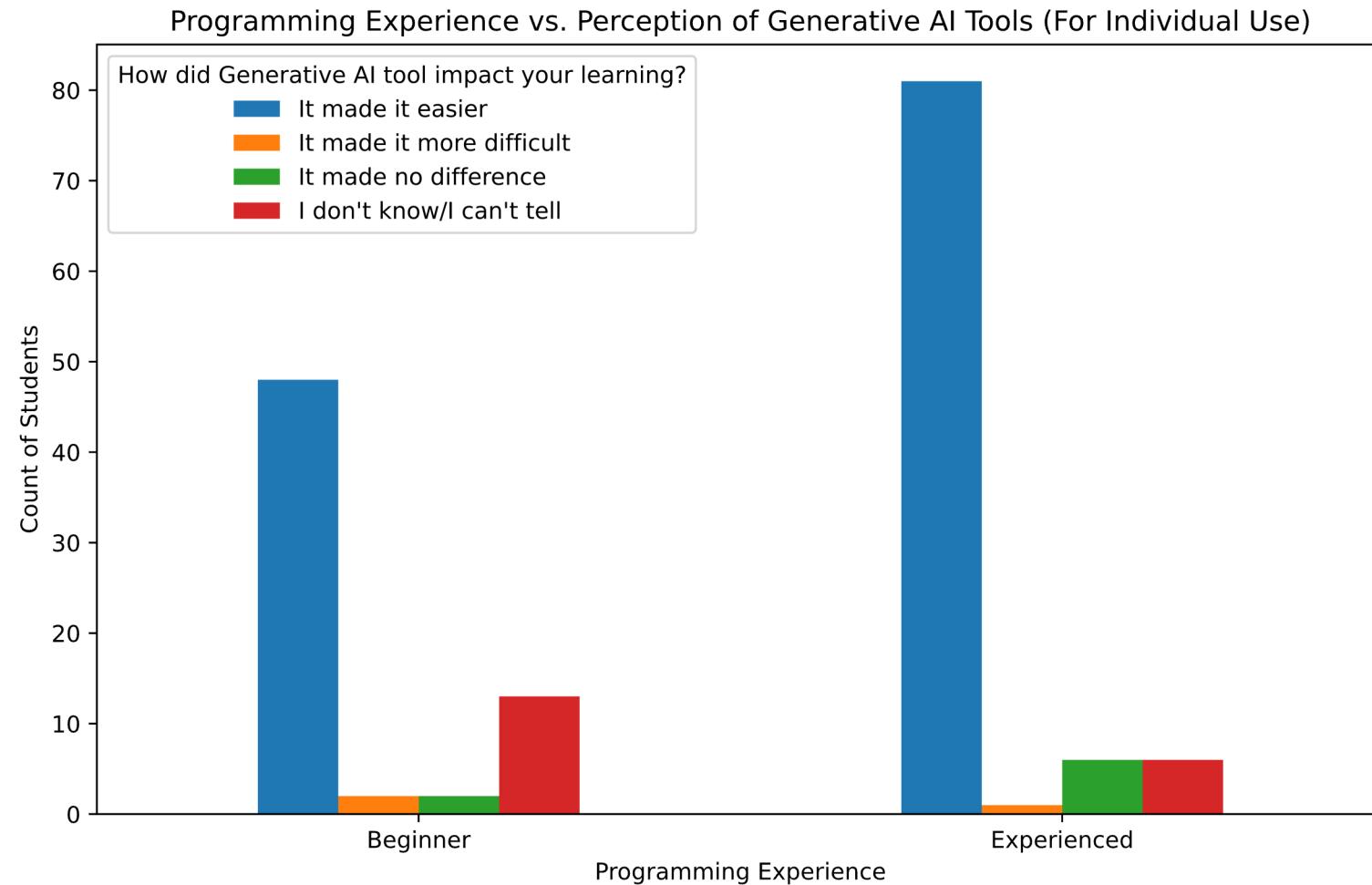
GENIAL initial survey results: the student experience



ChatGPT was known and used by nearly 100% of participants

Grammarly is also well-known (but likely not perceived as genAI)

GENIAL initial survey results: the student experience





Chat logs from GENIAL: examples from quantitative MSc course

The course policy

No specific restrictions but with a requirement to track key stages/tools utilised and reference use of generative AI tools. In all submissions in which you use Generative AI, you must **cite its usage** and **include the chat log in the assessment submission**. Failing to cite the use of Generative AI is academic misconduct.

Case study on deep learning assignments

- 2 individual summative assessments (take-home problem sets)
- Mix of coding, Maths and interpretation questions
- Two weeks to complete each of them
- Each worth 10% of final mark

~ 10 students (out of 90) submitted a chat log for each assignment: total of **20 chat logs**

3 patterns: post assignment, coding, pre assignment



Chat logs from GENIAL: examples from quantitative MSc course

The validation student: consulting the bot after having attempted the exercise

This is the question: ...

This is my answer: ...

What would you improve? Is the description factually accurate and precise?

Spellchecks, British English...

Pros:

- Good idea to check text, usually improves the flow (important to give a draft to maintain the style/length of text)

Cons:

- Might not pick up technical mistakes and reinforces students in their ideas (more on this later)



Chat logs from GENIAL: examples from quantitative MSc course

The coding student

- Produce code from scratch
- Debug code
- Adding small bits or modify code
- Ask to comment or summarise code
- Producing LaTeX code (e.g. starting from pictures)

Pros:

- Speeds up coding
- Generally good for debugging

Cons:

- Sometimes the bot gets lost
- Hard to use if you have zero/limited coding knowledge

Let $\alpha = 2n$. $W_1 = \begin{bmatrix} 1 & 0 & 0 & \cdots & 0 \\ -1 & 0 & 0 & \cdots & 0 \\ 0 & 1 & 0 & \cdots & 0 \\ 0 & -1 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \ddots & \vdots \\ 0 & 0 & 0 & \cdots & 1 \\ 0 & 0 & 0 & \cdots & -1 \end{bmatrix}$ $b_1 = 0$

can you write the latex code for me

ChatGPT

Certainly! Here's the LaTeX code corresponding to the image you provided:

```
latex
\documentclass{article}
\usepackage{amsmath}
\begin{document}
Let $\alpha = 2n$. $W_1 = 
\begin{bmatrix}
1 & 0 & 0 & \cdots & 0 \\
-1 & 0 & 0 & \cdots & 0 \\
0 & 1 & 0 & \cdots & 0 \\
0 & -1 & 0 & \cdots & 0 \\
\vdots & \vdots & \ddots & \ddots & \vdots \\
0 & 0 & 0 & \cdots & 1 \\
0 & 0 & 0 & \cdots & -1
\end{bmatrix}_{2n}
, $b_1 = 0
\end{document}
```



Chat logs from GENIAL: examples from quantitative MSc course

The "I will ask anything" student: used before attempting the assignment

- *Substitute of book or papers*
- *Substitute of dictionary*
- *Substitute of search engine*
- *Substitute of thinking?*

Pro:

- It can answer with very specific and extended prompts (for example specifying course context)

Cons:

- Hard to check sources and compare
- If the prompt is vague or not enough details/context, the bot might mislead
- It might not be compliant with course policy

 Anonymous

What is conjecture function

 ChatGPT

The term "conjecture function" isn't widely recognized in mathematics or computer science in a general context. Conjectures are propositions that are suspected to be true based on preliminary evidence but have not been proven or disproven. In mathematics, famous conjectures like the Riemann Hypothesis or Goldbach's Conjecture relate to specific properties of numbers or mathematical structures, but they don't define functions themselves.

However, the term could be used in specific contexts or studies to refer to a function that is part of a conjecture, or it might be a concept from a specialized area of research not broadly known. Without more context, it's challenging to provide a precise answer.

If you're referring to a specific concept from a particular field or study, could you provide more details or clarify the context in which you encountered the term "conjecture function"? This would help in giving a more accurate and helpful response.

 Anonymous

I mean if i regress picture to itself in a MNIST dataset and use neural networks

 ChatGPT

When you mention regressing a picture to itself in the context of the MNIST dataset using neural networks, it sounds like you're referring to the task of reconstructing the input images, which is typically a job for autoencoders. Autoencoders are a type of neural network used for unsupervised learning, where the goal is to learn a compressed, dense representation (encoding) of the input data, and then reconstruct the input data as closely as possible from this encoding (decoding).

Hard to see a bot telling you
your question does not make
sense

Sometimes a simple
dictionary might solve many
problems



 Anonymous

What if I got the prediction regressed pictures all the same output of the initial training set (one digit)

 ChatGPT

If your neural network, trained on the MNIST dataset to regress or reconstruct the input images, is outputting the same digit for all inputs despite the inputs being different digits, this indicates a problem with the model's learning process. Several issues could lead to this outcome:

1. Overfitting to a Specific Digit: If your model is overfitting, it might have learned to reproduce a specific output very well but fails to generalize to other inputs. However, overfitting usually results in high accuracy on the training set (not necessarily producing the same output for all inputs), so this might not be the exact cause if you're seeing the same output for different inputs.

2. Underfitting/Lack of Model Capacity: The model might not have enough capacity (i.e., not enough parameters or too simplistic architecture) to learn the complex mappings required to reconstruct the diverse set of digits in the MNIST dataset. This could lead it to default to outputting a "mean" or "common" representation that somewhat minimizes loss across all inputs but doesn't accurately represent any specific input.

3. Poorly Chosen Loss Function: If the loss function does not appropriately penalize the difference between the predicted and actual images, the model might converge to

 Anonymous

wait, I mean is it any type of a conjecture happening here

 ChatGPT

If you're observing a neural network model that is trained on the MNIST dataset and it regresses every input picture to the same output (one specific digit), regardless of the input, and you're wondering if this behavior can be considered a form of conjecture, it's a bit of a nuanced situation



Chat logs from GENIAL: examples from quantitative MSc course

The "I will ask anything" student: used before attempting the assignment

- *Substitute of book or papers*
 - *Substitute of dictionary*
 - *Substitute of search engine*
 - *Substitute of thinking?*
-
- Bot is very polite, hard to see a clear statement
 - Does usually not admit question is not clear/contradictory
 - Hard to see "I don't know" or denying an answer when not sure

False sense of security, reinforcement of your own ideas

■ (non-exhaustive list of) Existing policies and guidelines

- (2018) **The impact of artificial intelligence on learning, teaching, and education** – policies for the future. Joint Research Centre, European Commission Science and Knowledge Service [11]
- (May 2023) **Artificial intelligence and the future of teaching and learning** – insights and recommendations. Office of Educational Technology [12]
- (October 2023) **Generative artificial intelligence in education**. UK Dept. of Education [13]
- (2023) **ChatGPT and artificial intelligence in higher education** – quick start guide. UNESCO [14]
- (2023) **Technology in education – a tool on whose terms?** UNESCO [15]
- (February 2024) **AI use in assessments: protecting the integrity of qualifications**. Joint Council for Qualifications [16]
- (April 2024) **LSE statement on Generative Artificial Intelligence and education** [17]



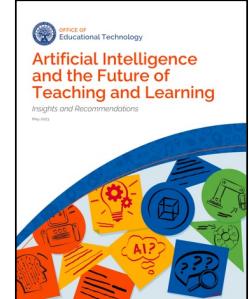
■ Existing policies and guidelines

■ Context

- "The **impact** of these technologies in practical educational settings **has been relatively modest** until recently. Technical developments over the recent years, however, suggest that **the situation may be changing rapidly**."
- "it may be easy to think that **AI is rapidly becoming super intelligent** and gain all the good and evil powers awarded to it in popular culture. This, of course, is not the case. **The current AI systems are severely limited**, and there are technical, social, scientific, and conceptual limits to what they can do..."

■ Current developments and envisaged impact (at that time)

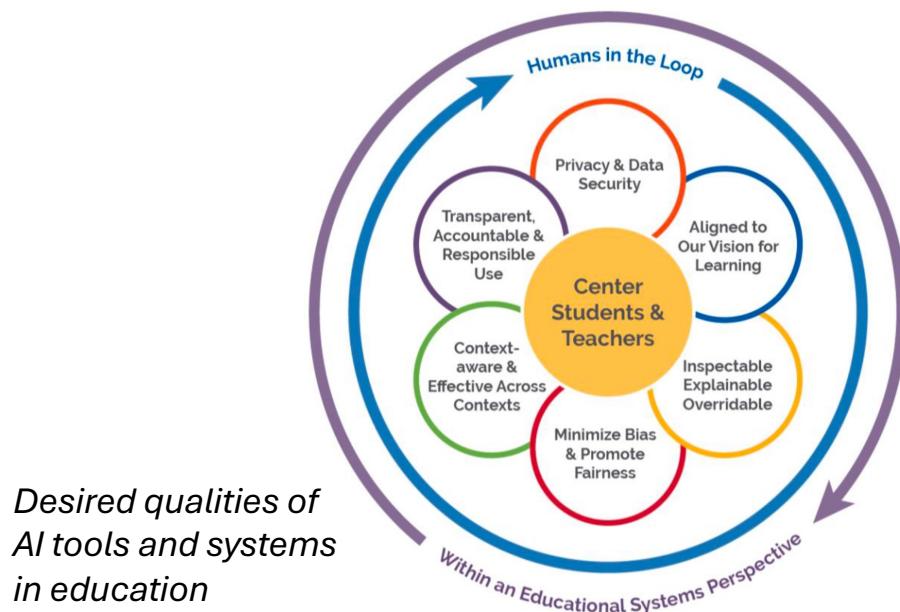
- AI for automatic test generation and assessment
- Computer-supported learning environments: diagnose student attention, emotion, and conversation dynamics
- "**No AI without UI**" principle: collect real-time input from learner behaviour + historical data to model learner
- Conversational natural language systems leading to teachable conversational agents
- Need to create **future-oriented models for education and teaching**, to prevent AI from mechanising and reinventing outdated teaching practices.
- The balance may shift from the instrumental role of education towards its more developmental role.
- A **general policy change** is to increase educators' and policymakers' awareness of AI technologies and their impact.



■ Existing policies and guidelines

■ Context

- Duality: learning with and about AI
- "ACE (always center educators) in AI" practice => *what are the loops in which teachers should be centered?*
- Balancing human and computer decision making



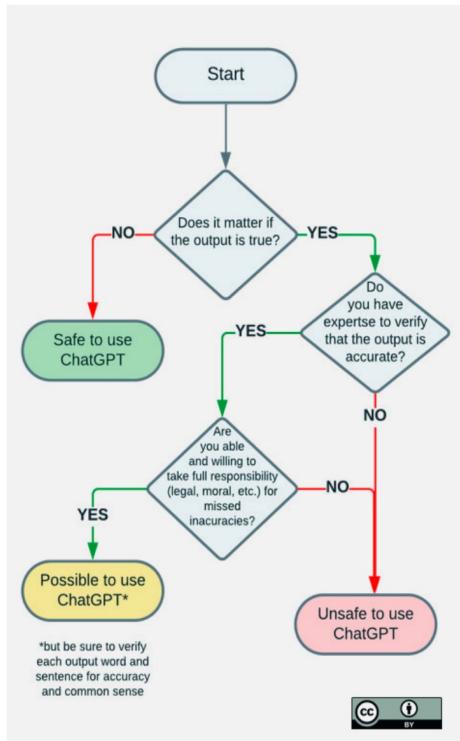
Recommendations

- ✓ Emphasize humans in the loop
- ✓ Align AI models to a shared vision for education
- ✓ Design using modern learning principles
- ✓ Prioritise strengthening trust
- ✓ Inform and involve educators
- ✓ Focus R&D on enhancing trust and safety
- ✓ Develop education-specific guardrails and guidelines



■ Existing policies and guidelines

Figure 1: When is it safe to use ChatGPT?⁵



| Role ⁶ | Description | Example of implementation |
|---------------------|--|--|
| Possibility engine | AI generates alternative ways of expressing an idea | Students write queries in ChatGPT and use the Regenerate response function to examine alternative responses. |
| Socratic opponent | AI acts as an opponent to develop and argument | Students enter prompts into ChatGPT following the structure of a conversation or debate. Teachers can ask students to use ChatGPT to prepare for discussions. |
| Collaboration coach | AI helps groups to research and solve problems together | Working in groups, students use ChatGPT to find out information to complete tasks and assignments. |
| Guide on the side | AI acts as a guide to navigate physical and conceptual spaces | Teachers use ChatGPT to generate content for classes/courses (e.g., discussion questions) and advice on how to support students in learning specific concepts. |
| Personal tutor | AI tutors each student and gives immediate feedback on progress | ChatGPT provides personalized feedback to students based on information provided by students or teachers (e.g., test scores). |
| Co-designer | AI assists throughout the design process | Teachers ask ChatGPT for ideas about designing or updating a curriculum (e.g., rubrics for assessment) and/or focus on specific goals (e.g., how to make the curriculum more accessible). |
| Exploratorium | AI provides tools to play with, explore and interpret data | Teachers provide basic information to students who write different queries in ChatGPT to find out more. ChatGPT can be used to support language learning. |
| Study buddy | AI helps the student reflect on learning material | Students explain their current level of understanding to ChatGPT and ask for ways to help them study the material. ChatGPT could also be used to help students prepare for other tasks (e.g., job interviews). |
| Motivator | AI offers games and challenges to extend learning | Teachers or students ask ChatGPT for ideas about how to extend students' learning after providing a summary of the current level of knowledge (e.g., quizzes, exercises). |
| Dynamic assessor | AI provides educators with a profile of each student's current knowledge | Students interact with ChatGPT in a tutorial-type dialogue and then ask ChatGPT to produce a summary of their current state of knowledge to share with their teacher/for assessment. |

Teaching and learning

Recommendations

- ✓ Use ChatGPT with care and creativity
 - Impact, guidance, learning outcomes, assessment, integrity and honesty
- ✓ Build capacity to understand and manage AI
 - New programmes and courses, AI literacy, staff training, peer support
- ✓ Conduct an AI audit
 - Understand, decide, and monitor

■ Existing policies and guidelines

■ Key messages

- Safety, security and responsible use of AI
- Effective practice
- Knowledge and skills for the future
- Fairly and robust assessment system

Guiding principles for responsible development and use of AI

- o Safety, security and robustness
- o Appropriate transparency and explainability
- o Fairness
- o Accountability and governance
- o Contestability and redress

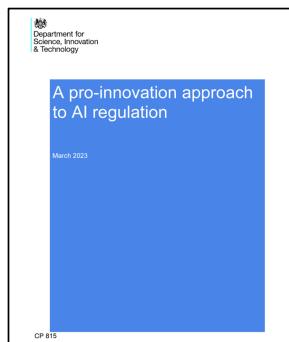


Figure 1: Illustration of our strategy for regulating AI



■ LSE existing guidelines

■ Teaching

- **No authorised use:** The use of Generative AI is not permitted in this department/course. Using generative AI to aid in or fully complete your coursework will be considered academic misconduct and you will be penalised.
- **Limited authorised use:** The use of Generative AI is permitted for specific components of assessment on this department/course.
- **Full authorised use:** The use of Generative AI is permitted on this department/course. In all submissions in which you use Generative AI, you must [cite its usage](#).

■ Assessment

- Departmental and/or course-level guidance on formative and summative assessment
- What is acceptable and how this should be acknowledged in the submission

■ Research

- Human in the loop at every stage
- GenAI as assistant or copilot to enhance productivity for micro-level tasks
- Researchers accountable for work produced by GenAI

What should we be aware of when designing a policy?

Academic misconduct

- Widespread underreporting even when the policy allows usage without constraints
- Very hard to prove academic misconduct, procedure hard to scale

Students' AI literacy

- Students need to be aware of pitfalls of GenAI and how can they use it (if possible) to help with learning

Instructors' AI literacy and biases

- Instructors need to **design assignments** assuming that most students will use GenAI
- Courses on AI literacy: teaching **about** AI and teaching **with** AI
- Instructors' strictness when marking [18]

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- [4] Gamification [[link](#)]
- [5] The Moodle story - <https://moodle.com/about/the-moodle-story/>
- [6] Redit - <https://en.wikipedia.org/wiki/Reddit>
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