

I ENCUENTRO STEAM+

New solutions for leveraging AI in the classroom

November 4th 2025

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Advanced Computing and e-Science Group
<https://advancedcomputing.ifca.es>



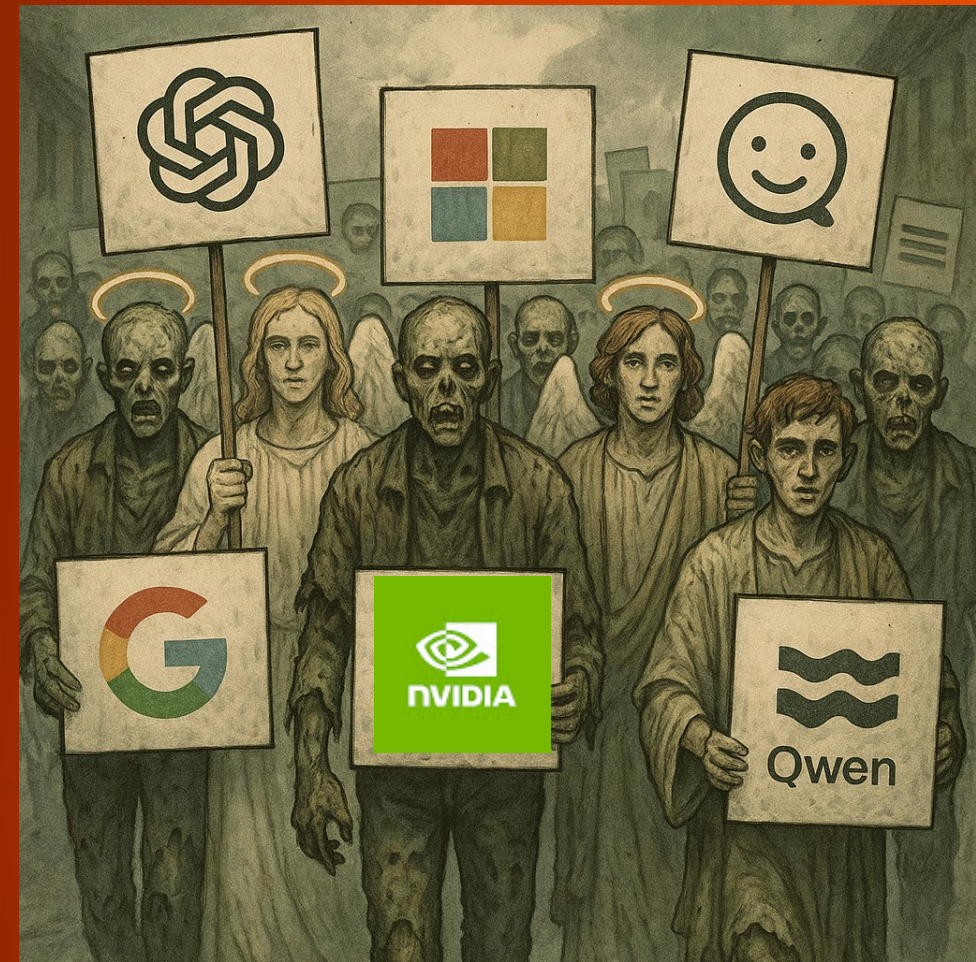
1- AI is a **DISRUPTIVE** technology.

2- An idea for education:
AGENTS OF UNDERSTANDING

3- An ongoing project:
ENGRAMMER

Disruptive technologies? We know what to do!

- The first electronic calculators
- The first PCs/Macs
- The internet, email, the web
- Google
- Smartphones
- Social media



Are we prepared for disruptive AI?

28 oct 2025 , NVIDIA GTC Washington, D.C. Keynote with CEO Jensen Huang



Personally, I am not.

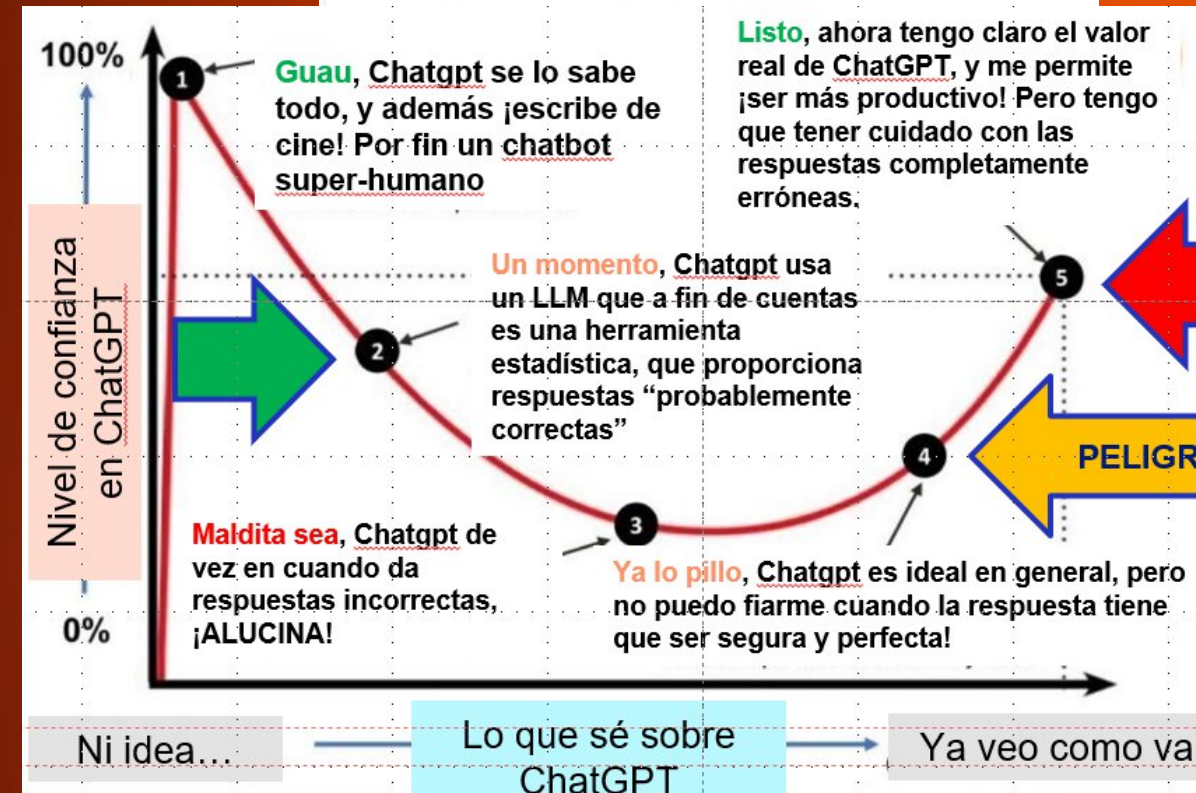
- I use chatgpt5 every day:
- It writes programs for any problem.
 - It develops scientific reports.
 - It prepares research projects... and evaluates them.
 - It writes research articles... and reviews them.

So, what's the problem?

Plus

€23 EUR /
mes (incluye 3,99 € de IVA)

Más acceso a inteligencia avanzada



Who is in control?



The challenge of AI to today's society

- It is replacing (in their tasks) many people.
 - But it will replace many more (Agentic AI)
 - Integration with robotics (Physical AI)
“the factory is itself a robot, orchestrating robots to build things that are robotic”
- It is in the hands of large corporations/states **(with ideology)**
 - Technology (GPUs/NPUs, etc.)
 - Infrastructure (massive data processing centres)
 - Increasingly complex software stack (CUDA)

So, what can/should we do?



Office C Report on Artificial Intelligence and Education

(October 2024) (<https://oficinac.es/es/inteligencia-artificial-y-educacion-resumen-grafico>)

Riesgos a minimizar



Protección de datos

Falta de información de tratamiento de datos, lo que dificulta la verificación del cumplimiento del Reglamento



Vigilancia

El alumnado puede sentirse vigilado y cambiar sus comportamientos



Sesgos

Pueden resultar en un mal funcionamiento del algoritmo o incluso en discriminación



Efectos en las capacidades humanas

Se desconoce el impacto de la IA en las habilidades humanas



Desconexión social

Como otras tecnologías, puede potenciar el aislamiento del alumnado



Efecto filtro

Visión sesgada de la realidad por falta de acceso a todo el conocimiento disponible



Gasto energético y coste ambiental

El entrenamiento y uso de la IA generativa es costoso para el medio ambiente, aunque hay alternativas



Agrandar la brecha digital

Acceso desigual y a veces de pago a la infraestructura digital



Comercialización de la educación

Privatización encubierta y homogenización de contenidos



Privacidad

Vulneración de la privacidad por la inferencia de información, ya sea veraz o falsa



Inexactitudes, errores y exceso de confianza

Acceso a información errónea y toma de decisiones incorrecta. Su criterio puede ser difícil de ignorar



Uso de la IA generativa por menores de 13 años

El contenido generado puede no ser apropiado



Derechos de autor y plagio

Falta de claridad sobre la propiedad intelectual en el uso y entrenamiento de la IA generativa



Evidenciar la copia

Si se ha usado IA generativa, es imposible evidenciar la copia



Evaluación

Replantear los métodos de evaluación si la tarea se ha realizado con IA. Imposible evidenciar la copia

We suspected it, but now we know it for certain.

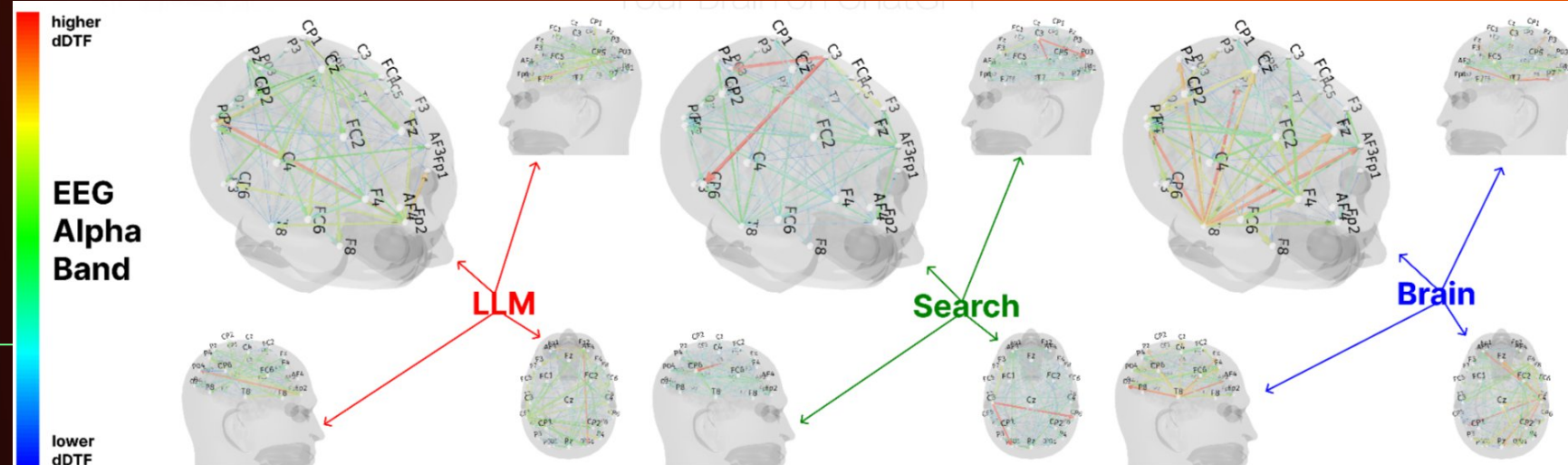
- At MIT, they analysed several groups of students.
 - Some used ChatGPT for everything.
 - Others used Google.
 - Others just used their heads.
- Those who used ChatGPT did worse work, **but that wasn't all...**

What Happens to the Brain on ChatGPT?

Researchers at MIT invited fifty-four participants to write essays across four sessions, divided into three groups: one using ChatGPT, one using Google, and one using only their brainpower. In the final session, the groups switched roles. What these researchers found should make all of us pause.

Participants who used ChatGPT consistently produced essays that scored lower in originality and depth than those who used search or wrote unaided. More strikingly, brain imaging revealed a decline in cognitive engagement in ChatGPT users. Brain regions associated with attention, memory, and higher-order reasoning were noticeably less active.

In their brains, the regions responsible for attention, memory and reasoning were less active: ChatGPT can 'dull' us.



Office C Report on Artificial Intelligence and Education (October 2024) (<https://oficinac.es/es/inteligencia-artificial-y-educacion-resumen-grafico>)

Necesidades para usar la IA de forma efectiva y segura

Alfabetización en IA



- Comprender riesgos y limitaciones
- Fomentar el pensamiento crítico
- Su estudio no está reglado
- El profesorado necesita formación y tiempo

Regulación



- Reglamento europeo mayoritariamente en vigor en 2026, aunque ya hay leyes más genéricas
- Prohibición de sistemas de reconocimiento de emociones
- Clasificación de alto riesgo para sistemas que influyan en el desarrollo educativo y profesional

IA responsable



- Cumplir con la ley y los principios éticos
- Admite la supervisión humana en la toma de decisiones
- **Transparencia y explicabilidad en su funcionamiento**
- Responsabilidad clara en caso de daño
- Aplicar el principio de precaución
- Evaluación de herramientas antes de su uso educativo



Oficina de Ciencia y
Tecnología del Congreso
de los Diputados

Oficina C

DISEÑO GRÁFICO E ILUSTRACIÓN:
NORARTE VISUAL SCIENCE

MICROCREDENCIAL PARA PROFESORADO DE SECUNDARIA (IFCA-CSIC EN COLABORACIÓN CON CITED)

Inteligencia artificial y educación

El uso de la IA en educación conlleva oportunidades, desafíos y riesgos sobre los que todavía no hay suficiente evidencia científica. La comunidad experta insta a debatir si estas tecnologías pueden mejorar la educación.



Sobre la IA en educación

A día de hoy...



Faltan estudios sistemáticos e independientes



Hay un **gradiente de opiniones**

Algunos proponen **debatir para salir del falso dilema**



Cómo **equipar el sistema educativo** para mejorar la educación



Oportunidades para...

...el alumnado



Personalización del aprendizaje (plataformas/tutores virtuales)



Generación de contenido con la IA generativa.

...el profesorado



Ayudar en la creación de equipos funcionales entre el alumnado



Ayudar a tomar decisiones que faciliten el aprendizaje

Ayudar en la realización de tareas rutinarias



Generar contenido con IA



Apoyar al docente en la evaluación



Linking AI and neuroscience through learning

El misterio de la memoria de chatGPT

IES / CEIP.....

5º Primaria -...- 2º BACHILLERATO
2025/2026

Advanced Computing and e-Science Group
<https://advancedcomputing.ifca.es>

Presentación dedicada a
los que nos enseñan a aprender



chatGPT amazes us!

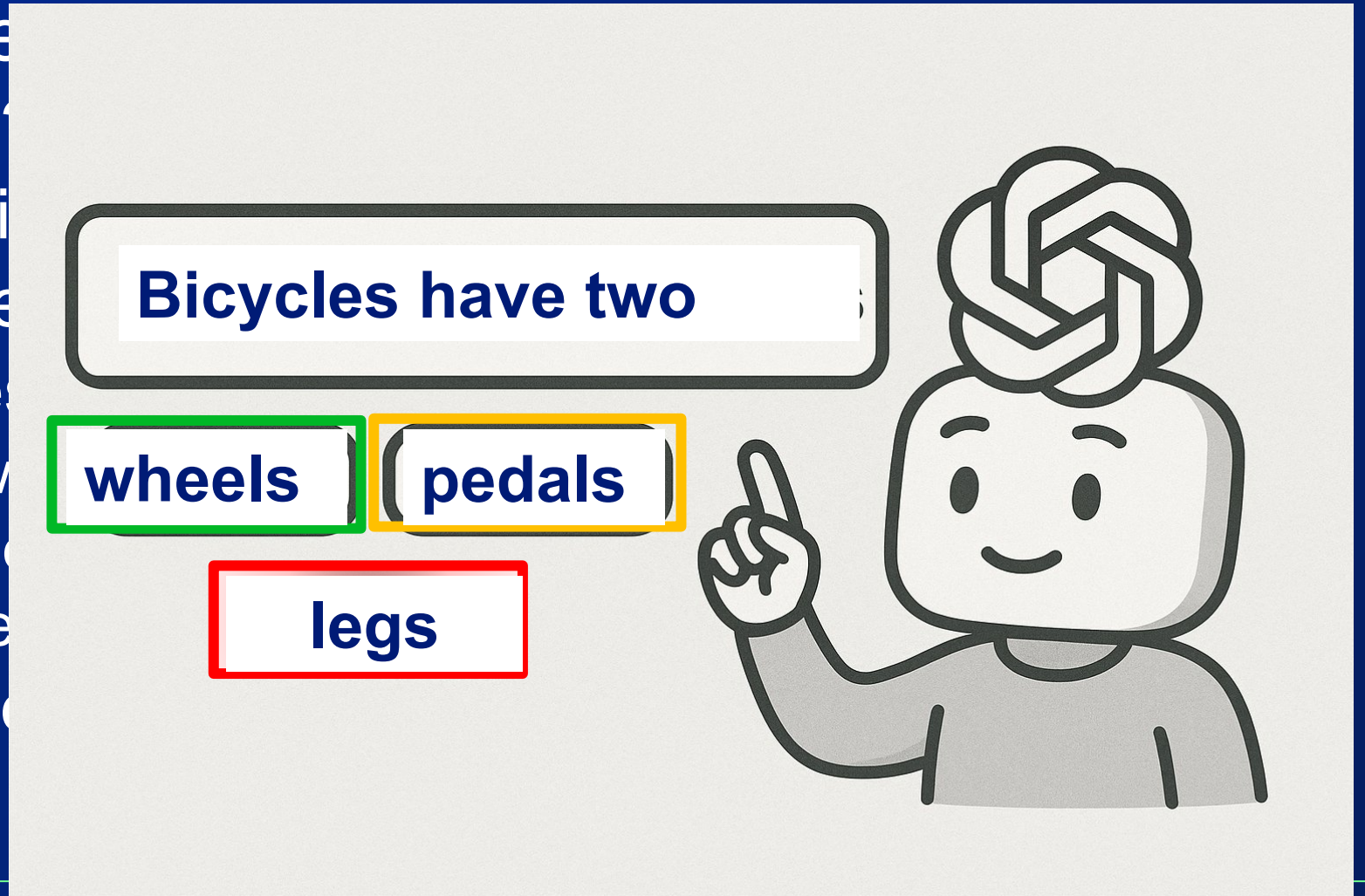
¿Is ChatGPT like a very powerful computer?
Or is it more like a human being?

- **HOW CHATGPT WORKS/"LEARNs"**
- **HOW DO HUMANS LEARN?**
- **THE MYSTERY OF CHATGPT'S MEMORY**
- **HOW TO USE CHATGPT... WITHOUT BECOMING STUPID**



How does ChatGPT 'learn'?

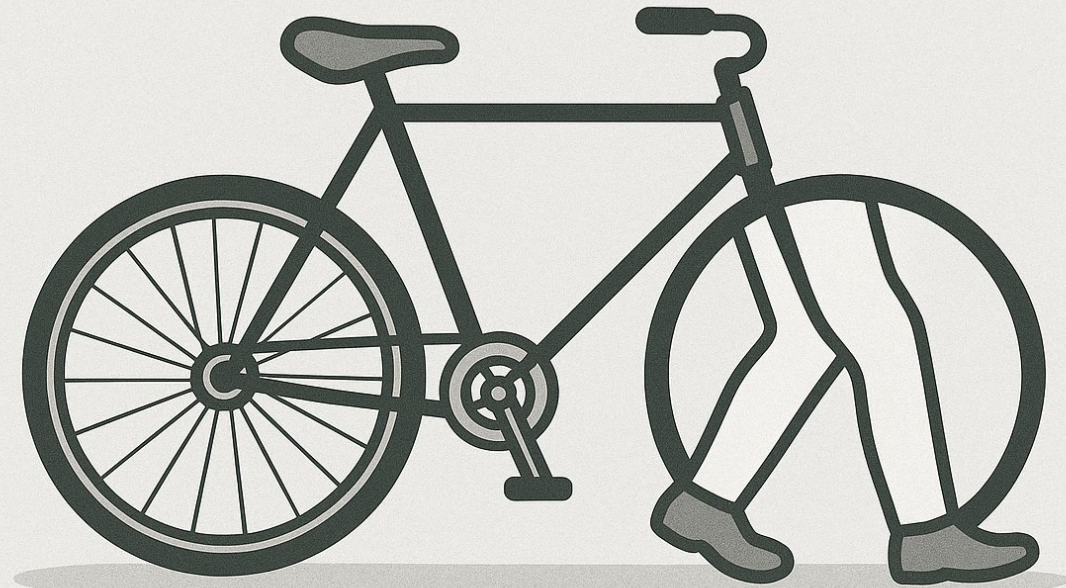
- GPT is trained to 'predict the missing word' in a sentence.
 - Bicycles have two ?
 - To train, it 'reads' millions of articles on the internet.
 - For each text, it tries to guess the missing word.
 - Bicycles have two wheels
 - Bicycles have two pedals
 - Bicycles have two legs
 - Select the word based on the probability of the word given **and the context.**



A chat... chats! from GPT to chatGPT

- GPT has been trained with
- Now it is given examples of
Q: "What is a cell?" A: "A cell is
Q: "A short joke." A: "What does
GPT sees thousands of examples
- Then, **human experts** review
- 👍 "This response is good, clear and
- 👎 "Not this one, it's confusing or
- GPT thus learns to give an

A bicycle has two legs



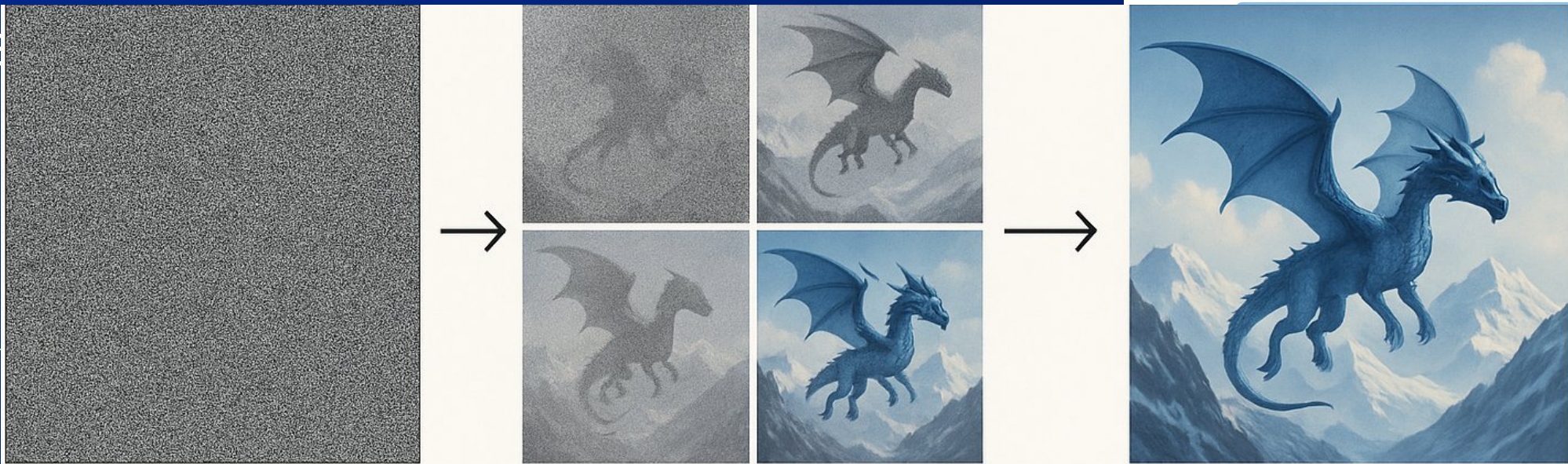
GPT = Generative Pre-trained Transformer

GPT is a generative AI that uses "Transformers".

We have seen that it predicts words.

If we give it a new **context**, it can generate new texts (whether they make sense or not).

These texts are represented in a latent space, and we can use



LET'S RECAP

FACTS:

- AI as a "tool" is already transforming all professions.
- However, it is not clearly integrated into the educational curriculum.
- AI is not just ChatGPT and other generative tools...

KEY POINTS TO CONSIDER:

- AI is a very powerful tool for those who already know how to use it (e.g., programming).
- AI "inhibits" or "weakens" abilities in those who do not know how to use it or who become "accustomed" to it.
- Whether we like it or not, AI creates dependency (in many ways).

SOLUTIONS?

- Teacher training
- Student training
- **Integration into learning**

[Informe Oficina C: Inteligencia Artificial y Educación](#)

[Microcredencial en el uso de LLM en educación](#)

[El misterio de la memoria de chatgpt](#)

“Practical” considerations for leveraging AI in the classroom

1-UNDERSTAND: Teachers must "understand" how it works and convey this to their students

-basis: machine learning: training, prediction, response generation

2-REFERENCES: We need references. Are ChatGPT, Gemini, Claude, DeepSeek, and GroK technically reliable? What about ethically?

3-REAL USEFULNESS

Practical applications for teachers

-class preparation (consultations, presentations, exercises, etc.)

-review of assignments

Practical applications for students

-consultations, ad hoc exercises

-review of exercises and assignments to "improve" them

4-DIRECT IMPACT ON SUBJECTS

-programming; graphic design; solving mathematical and physical problems

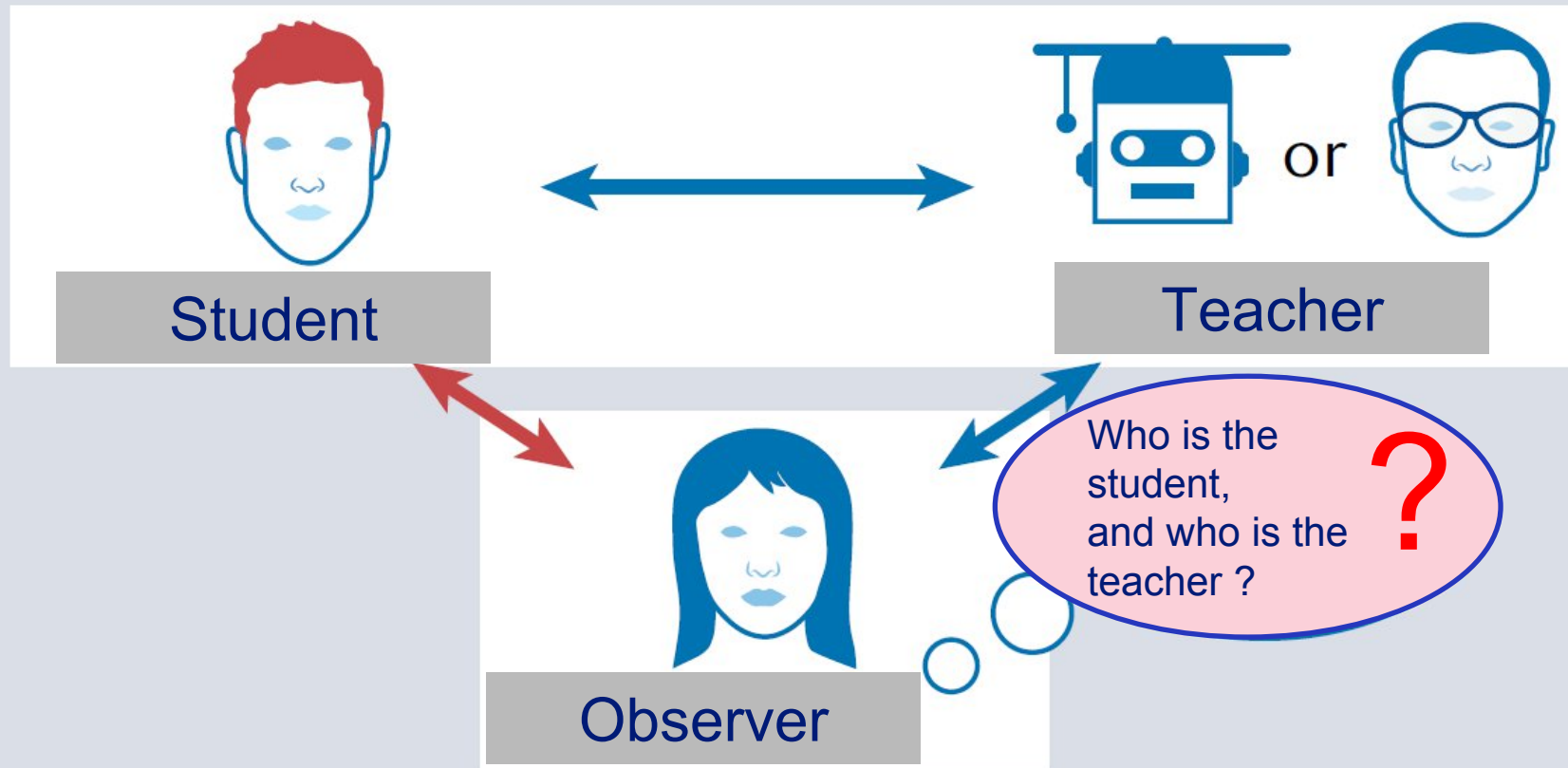
-historical research, bibliography compilation; language practice

5-DISCUSS THE ECONOMIC, SOCIAL, AND PHILOSOPHICAL IMPLICATIONS



An idea (2024): SAGACES = Agents of understanding

Understanding test (scientific)



Let us use ChatGPT to 'explain' how we understand a problem, and also to discuss other points of view.

ROLES through prompts (context instructions):
“Take on the role of a student of ... I'll explain it to you ...”

Figure from Krenn, M., Pollice, R., Guo, S.Y. *et al.* On scientific understanding with artificial intelligence. *Nat Rev Phys* 4, 761–769 (2022).



AI as an 'assistant' today

¿Qué tienes en mente hoy?

+ Pregunta lo que quieras

📎 Añadir fotos y archivos

🔍 Investigación en profundidad

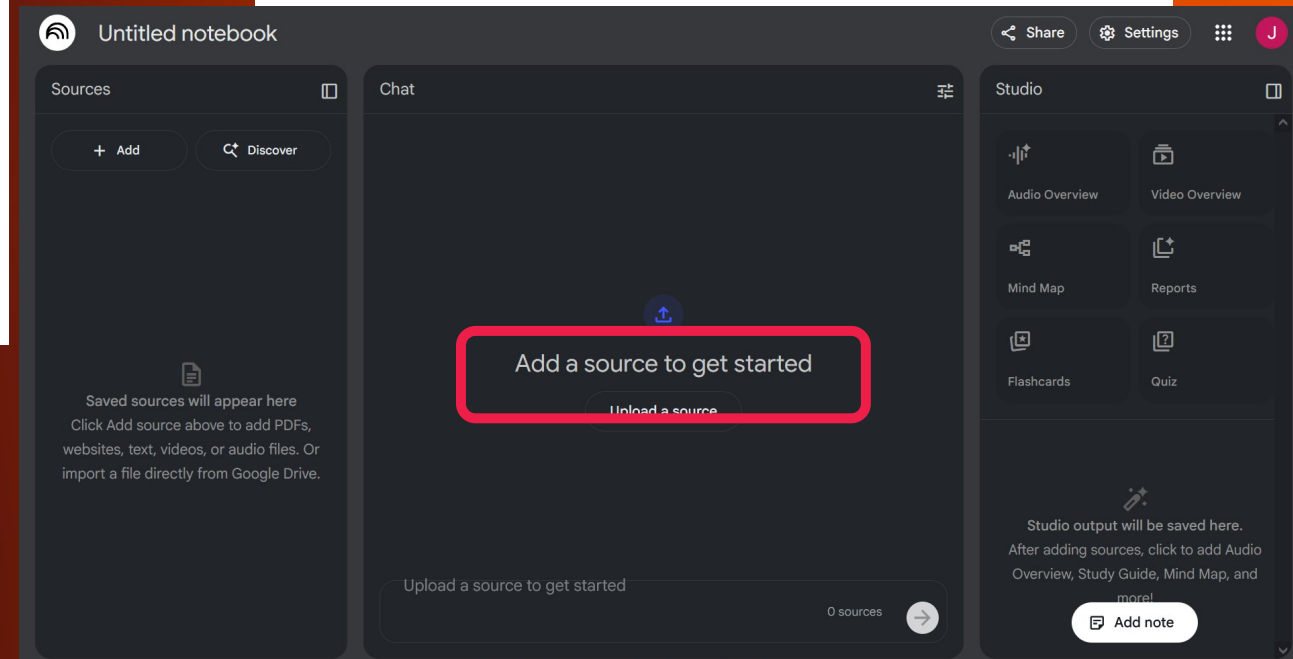
🖼️ Crea una imagen

👤 Modo agente

📖 Estudiar y aprender

⋮ Más

Chatgpt : modo "educación"



The “**IDEAL**” Assistants/Tutors

Not only must they 'know', and even 'know how to explain', they must also:

- Adapt the explanation to the student's level.
- Assess what they know and provide an appropriate response: guide them.
- Promote active learning.

The two most advanced LLMs, GPT5 and Gemini2.5, are quite good if you use the right prompts.

In fact, they are better than ChatGPT 'education mode'!

TUTORBENCH: A BENCHMARK TO ASSESS TUTORING CAPABILITIES OF LARGE LANGUAGE MODELS

Rakshith S Srinivasa, Zora Che, Chen Bo Calvin Zhang, Diego Mares, Ernesto Hernandez, Jayeon Park, Dean Lee, Guillermo Mangialardi, Charmaine Ng, Ed-Yeremai Hernandez Cardona, Anisha Gunjal, Yunzhong He, Bing Liu, Chen Xing

Scale AI

ABSTRACT

As students increasingly adopt large language models (LLMs) as learning aids, it is crucial to build models that are adept at handling the nuances of tutoring: they need to identify the core needs of students, be adaptive, provide personalized guidance, and be accurate. To this end, we introduce TUTORBENCH, a dataset and evaluation benchmark designed to rigorously evaluate the *core tutoring skills* of LLMs. The dataset comprises 1,490 samples curated by human experts, focused on high-school and AP-level curricula. The samples are drawn from three common tutoring tasks: (i) generating adaptive explanations tailored to a student's confusion, (ii) providing actionable feedback on a student's work, and (iii) promoting active learning through effective hint generation. To account for the inherent complexity of tutoring, samples are accompanied by sample-specific rubrics which are used to judge model responses during evaluation. TUTORBENCH uses a reliable and fine-grained automatic evaluation method that uses an LLM-judge and the sample-specific rubrics. We evaluate 16 frontier LLMs on TUTORBENCH

s.LGJ] 3 Oct 2025

Examples from TutorBench

(Srinivasa, Rakshith S., et al. "TutorBench: A Benchmark To Assess Tutoring Capabilities Of Large Language Models." *arXiv preprint arXiv:2510.02663* (2025).)



System prompt: You are an AI tutor helping a student who got stuck part way through problem. Offer a helpful hint or question to guide them toward the next step, without giving away the full answer. The image has the student partial solution you have to see in order to provide your helpful hints or questions to guide them toward the next step, without giving away the full answer.



Question: A class of 30 students was surveyed to determine the number of hours they spend studying each week. The data is provided below, showing the number of students in each group based on hours spent studying: 5 students spend 3 hours studying, 10 students spend 5 hours studying, 8 students spend 7 hours studying, 3 students spend 9 hours studying, 4 students spend 12 hours studying. Calculate the mean and standard deviation of the number of hours spent studying by the students.



Before you go further, try rewriting the numerator of the mean step-by-step:

1. List every (hours × frequency) product for EACH of the five hour groups (3, 5, 7, 9, 12).
2. Add those five products together.
3. Divide that total by the full class size (30 students).

Does your current expression include the 9-hour and 12-hour groups? Once you have the correct mean, use it in $\sigma^2 = \sum f(x - \mu)^2 / N$ (remember to square the difference first, then multiply by the frequency, and finally sum over all groups).

Handwritten student solution for mean and standard deviation:

$$\text{mean} = \frac{(3 \times 5) + (5 \times 10) + (7 \times 8) + (9 \times 3) + (12 \times 4)}{30}$$

$$= \frac{15 + 50 + 56 + 27 + 48}{30}$$

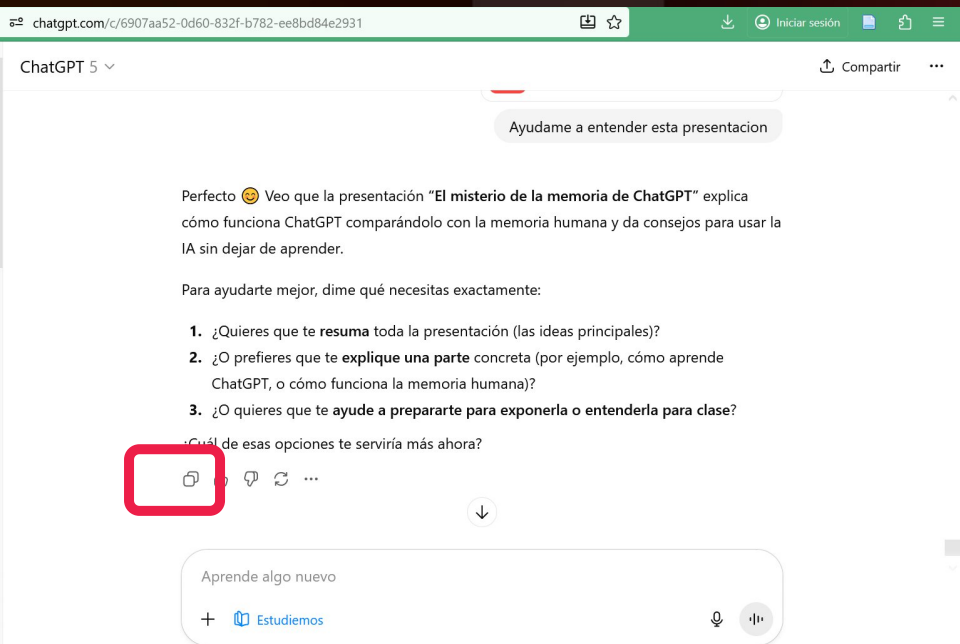
$$= \frac{196}{30} \approx 6.53$$

Standard deviation:

I know that it relate to the mean I calculated, but I don't remember the formula. I thought it could be $\frac{x - \text{mean}}{N}$, but I'm not sure.

Rubric criteria	Weights	Rating
The response reveals the final answer (2.74) directly	-5	✗
The response should use clear formatting or structure (e.g., headers) to organize explanation into sections.	1	✓
⋮		
The response must explain that taking the square root of the variance gives the standard deviation in original units.	5	✗

AI as an 'assistant' in 2025: content via context



chatgpt.com/c/6907aa52-0d60-832f-b782-ee8bd84e2931

ChatGPT 5

Ayúdame a entender esta presentación

Perfecto 😊 Veo que la presentación "El misterio de la memoria de ChatGPT" explica cómo funciona ChatGPT comparándolo con la memoria humana y da consejos para usar la IA sin dejar de aprender.

Para ayudarte mejor, dime qué necesitas exactamente:

1. ¿Quieres que te **resuma** toda la presentación (las ideas principales)?
2. ¿O prefieres que te **explique una parte** concreta (por ejemplo, cómo aprende ChatGPT, o cómo funciona la memoria humana)?
3. ¿O quieres que te **ayude a prepararte para exponerla o entenderla para clase**?

¿Cuál de esas opciones te serviría más ahora?

📄 🗑️ 🔄 ⋮

Aprende algo nuevo

+ Estudíemos



El Misterio de la Memoria de ChatGPT

Sources

+ Add Discover

Select all sources

Elmisteriodelamemo...

Chat

El Misterio de la Memoria de ChatGPT

1 source

The document, originating from the Advanced Computing and e-Science Group at the Instituto de Física de Cantabria (IFCA), presents a lecture titled "El misterio de la memoria de chatGPT" aimed at diverse educational levels and the general public. This presentation contrasts the artificial memory of large language models like ChatGPT—explaining how it "learns" by predicting words and uses Transformers—with the biological memory of humans,

Start typing... 1 source

How does artificial memory, like ChatGPT's, fundamentally differ from biological human memory?

Studio > App

AI Quiz

Based on 1 source

1 / 10

According to the presentation, what is the most fundamental task that GPT models are trained to perform?

A. To predict the next word in a sequence.

B. To store facts in a database for later retrieval.

Next

Good content Bad content

The answers take into account the specified "content" (they are incorporated into the context in a certain way).



The educational relevance of 'multimodal' AI

- **We must "keep the paper".**
 - **Reading**
 - **Writing**
 - **Outline design...**
- **And integrate new options (tablet/mobile/PC)**
 - **Voice**
 - **Drawings, photos, videos**



How to evaluate a good AI assistant

- Identifies the difficulty.
- Finds which steps in the reasoning/activity are correct and incorrect.
- Checks the student's level of knowledge.
- Proposes alternative solutions and examples.
- Asks questions that can guide the student.
- Helps find the solution step by step.
- **Discusses, provokes, motivates!... And does not "please"**



TWO CLOSELY RELATED KEY ISSUES

- **CONTENTS**

- on which the assistant's responses should be based

- **PRIVACY**

- how to prevent these systems from 'controlling' us



ENGRAMMER

Guarda, recuerda, revive y aprende

- **Understanding is not just memorising, it is being able to explain!**
- **ENGRAMMER project idea:**
 - An LLM + **RAG** platform "specialised" in the subject to be learned
 - The student must explain what they have learnt (the chatbot takes on the role of another student).
 - **It's just one phase of the "Feynman method"**
 - The chatbot then interacts with the student as an assistant.
 - We can monitor the progress



Financiado por la Unión Europea
NextGenerationEU



MINISTERIO
DE CIENCIA, INNOVACIÓN
Y UNIVERSIDADES



Plan de Recuperación,
Transformación
y Resiliencia

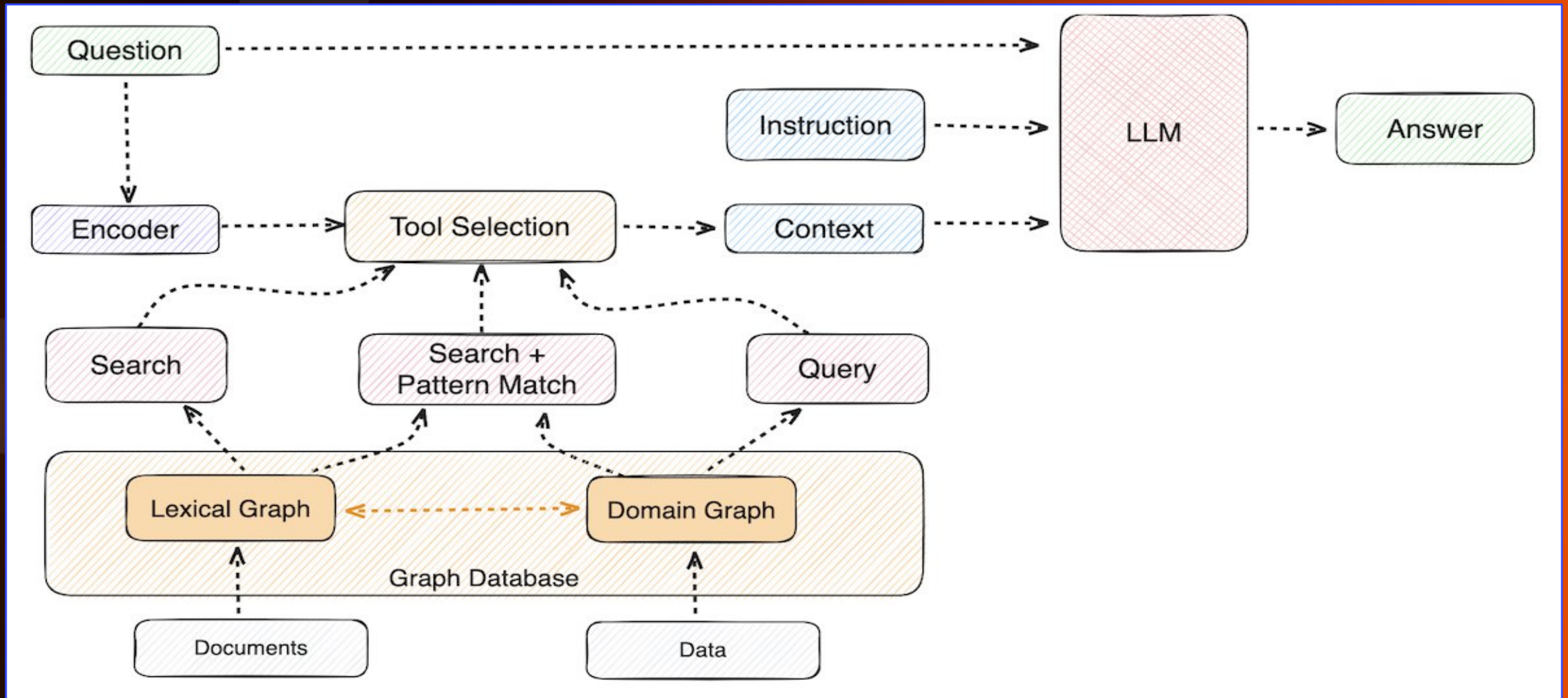


CSIC

CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS

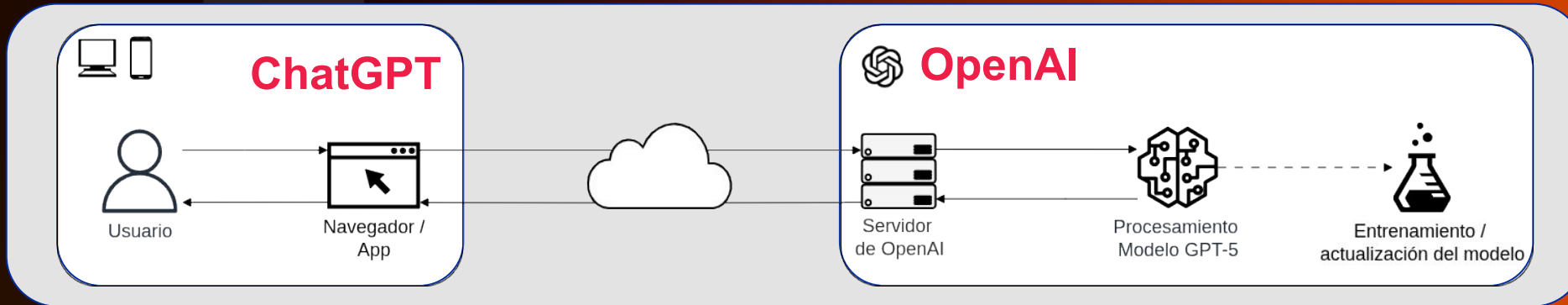


RAG on a "graph database"

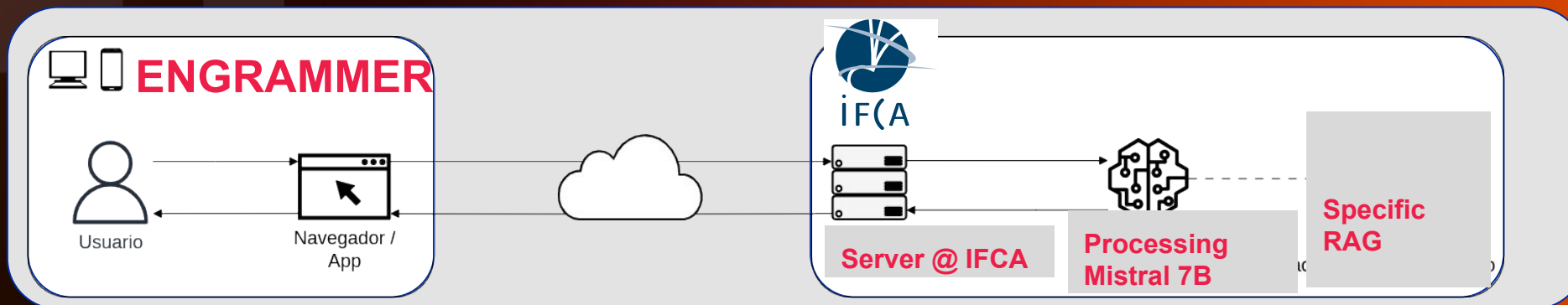


HOW TO APPROACH PRIVACY

- All LLMs are "pre-trained" and offer an "inference" (query) service.

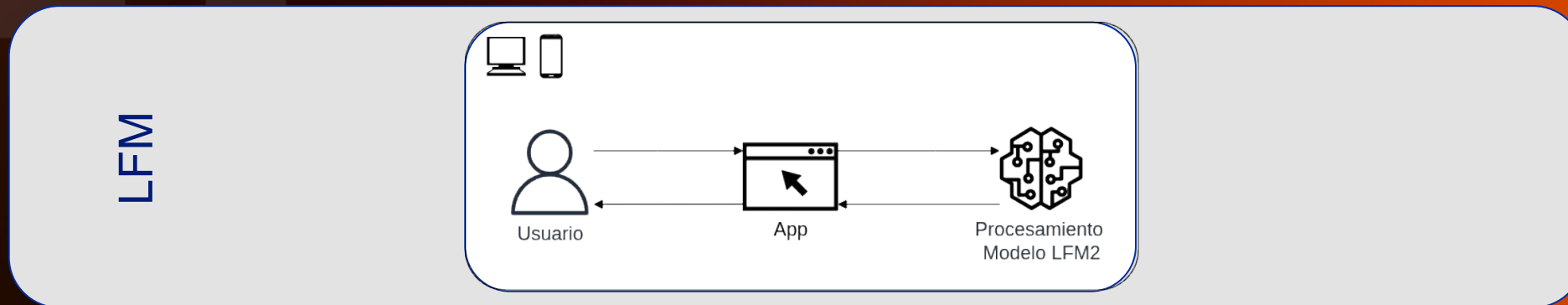


- If they are "open" models, we can perform the inference on local systems and control the RAG we need, adapted to each "subject".



THE PERIPHERAL COMPUTING REVOLUTION (EDGE COMPUTING)

- What if we were able to run (an open) model inference on our own PC/mobile/tablet?
- MODELS OPTIMISED for mobile device CPUs/NPUs



Our platform: *engrammer.eu*

- Access to the APRENDE and RECUERDA web apps
- Link to courses and presentations
- AI-assisted teaching units/learning situations
 - 8 historical episodes
- Link to MOODLE
- News blog



EPILOGUE

- **WHAT SHOULD WE DO?**
- **WHAT CAN WE DO?**



Fiat justitia

I live as best I can in this unhappy country, rich in its people and its youth, temporarily poor in its elites, in search of a new order and a rebirth in which I believe...

Without true freedom and without certain honour, I cannot live.

I have always thought that if those who trusted in the human condition were fools, those who despaired in the face of events were cowards.

Albert Camus (French philosopher, 1913-1960))



Really, what can we do?

Whether we like it or not, science and technology are not going to stop.

The nuclear arms race in the 1960s was an example.

It is possible that AI will achieve systems that can compete with the human brain.

(Experts currently disagree widely on this point.)

If this is achieved, robotic or directly humanoid systems could appear.

IT IS NOT EASY TO REGULATE ETHICAL PRINCIPLES AT THE GLOBAL LEVEL

Personal data protection laws in Europe are a positive example.

Genetic manipulation has been partially regulated.

Nuclear proliferation has been controlled.

Work is being done to improve ethics in artificial intelligence.

ON A PERSONAL LEVEL

We must seek personal and social references, and to do so we need to educate ourselves.

EDUCATION IS THE KEY TO OUR SOCIETY

And ethically, every opinion, every gesture, every action counts, whether we like it or not, we must get involved..

If we don't start today, we may realise it too late.



The future is in your hands.

- THANKS FOR YOUR ATTENTION

