



ECSS 2023

# AI and the Future of Informatics Education

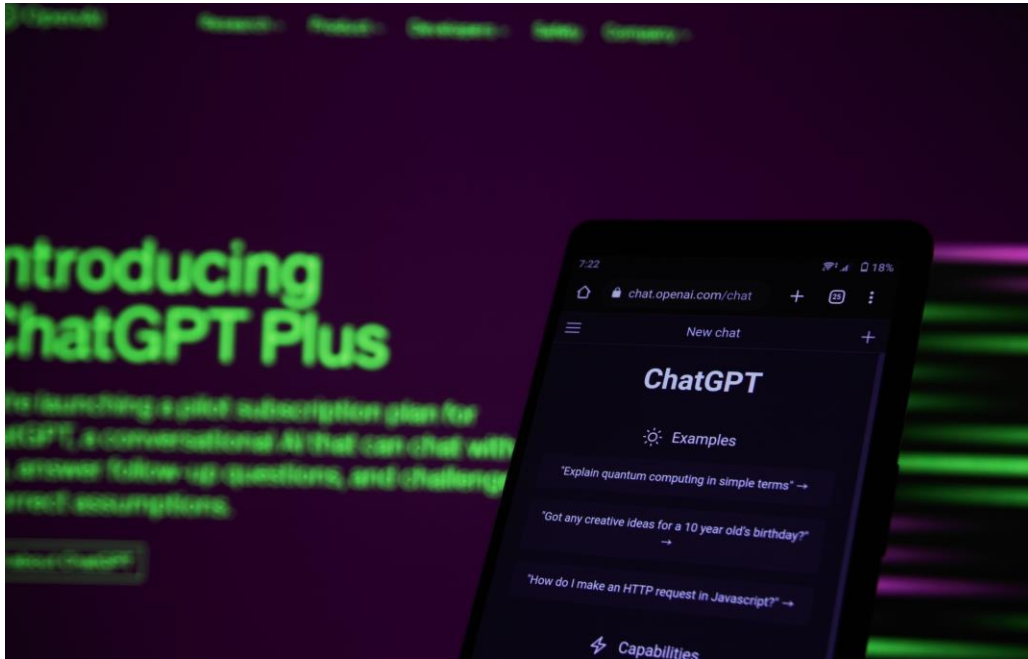


## Benefits, risks, and challenges of AI in informatics education

David Lopez



# Being disruptive



Whenever a promisingly disruptive technology emerges, it is accompanied by both technophile and technophobe discourses and positions

# Reactions to ChatGPT



Generative Artificial Intelligence “undermine our scientific pursuits and compromise our moral principles by integrating a fundamentally erroneous understanding of language and knowledge” N. Chomsky, I. Roberts & J. Watumull (2023)

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“Rather than reject these machines, and rather than replacing ourselves with them, we should reflect on what they can teach us about ourselves. They are, after all, images of humanity as reflected through the Internet” E. Lee (2023)

“The development of AI is as fundamental as the creation of the microprocessor, the personal computer, the Internet, and the mobile phone. It will change the way people work, learn, travel, get health care, and communicate with each other. Entire industries will reorient around it. Businesses will distinguish themselves by how well they use it. [...] The world needs to make sure that everyone—and not just people who are well-off — benefits from artificial intelligence. Governments and philanthropy will need to play a major role in ensuring that it reduces inequity and doesn't contribute to it”

Bill Gates (2023)





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 attention to an answer being absurd. strate," he said. "Teachers are shy."

The arrival of generative Artificial Intelligence in the classroom has been compared to the advent of the calculator. (R. Johinke, R. Cummings and F. Di Lauro, 2023)

A transformative technology so profoundly changes the capabilities of the workplace and the culture at large that the goals within the classroom must change

This is not the first time!

# Disruption in Higher Education: first time?

## The academy has enormous resistance to change

1990's: Students can access to the Internet

- Much more than custodians and transmitters of knowledge



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2020: COVID-19

- It showed the weaknesses of the education system



# Disruption in Higher Education

## Generative AI in 2022

AI is here to stay

What can we do?

# Disruption in Higher Education

## Generative AI in 2022

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What can we do?



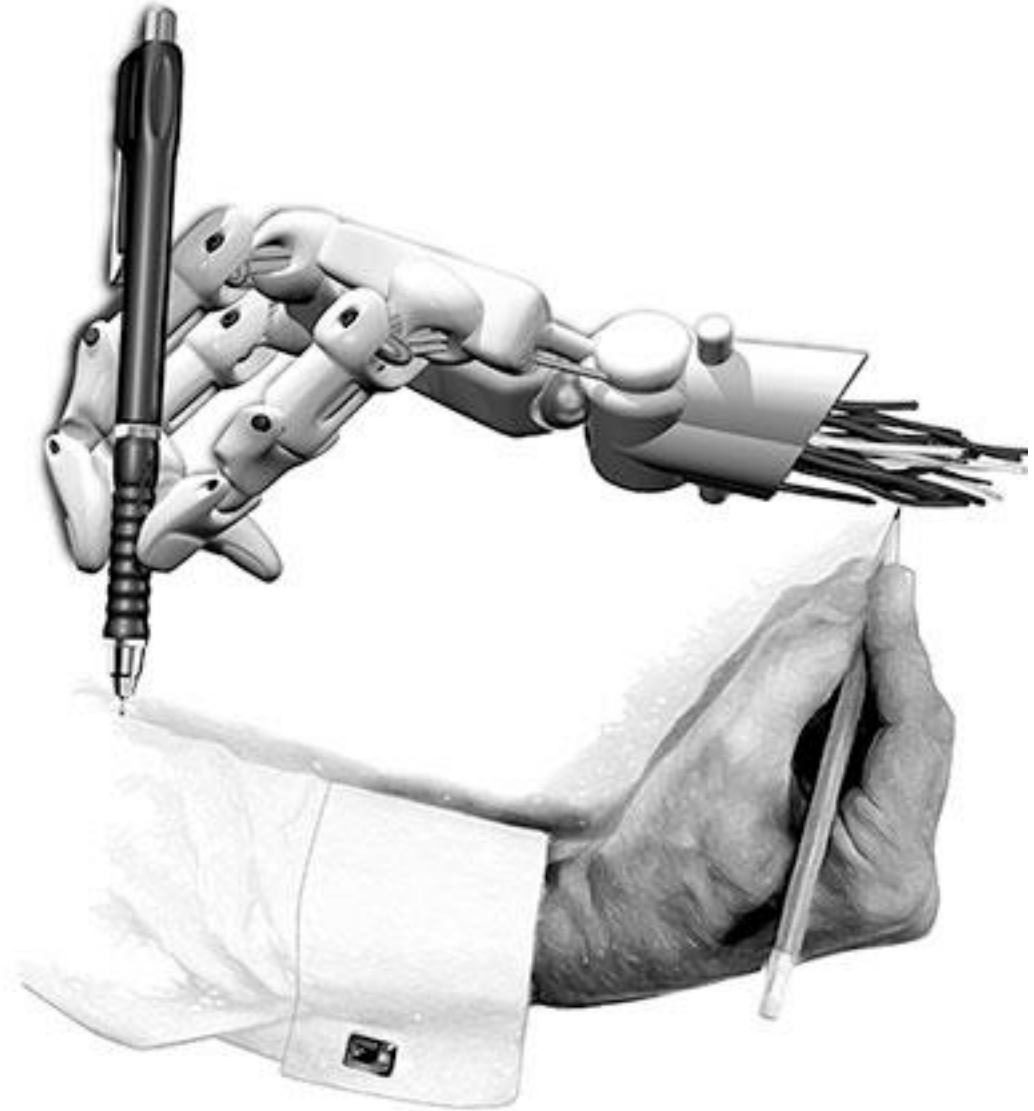
# Disruption in Higher Education

## Generative AI in 2022

AI is here to stay

As history has shown, prohibitions are often not as effective as intended

Perhaps the time for real change has come



# Problems and dangers



The problems do not arise from the appearance of ChatGPT or other AI tools

THEY ALREADY EXIST

The potential of these technologies and their rapid penetration are magnifying the existing problem

# Problems and dangers

Mark Guzdial (2018) argues that historically we have viewed programming as a series of human-understandable abstractions in the form of deterministic, verifiable data structures and algorithms. With the advent of Machine Learning techniques, the model becomes a composite of millions of parameters, not a human-readable algorithm, and its verification is no longer a logical test of correctness, but a statistical demonstration of effectiveness.

This does not mean that classical programming should cease to be taught!



# Problems and dangers

Give the pupils something to do, not something to learn; and when the doing is of such a nature as to demand thinking; learning naturally results

- John Dewey



If we teach today's students as we taught yesterday's, we rob them of tomorrow

- John Dewey

# Helping students to learn



1. Access to a large amount of relevant information in real-time to later process, summarize, and present as if it were a human
  - Supportive tools for learning new concepts compared to traditional media, including the ability to summarize or explain complex concepts
  - Understanding context, enabling interaction (dialogue) with these tools



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3. Facilitating the development of language skills

# Challenges regarding students



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1. Development of students' competencies in generative AI, with an emphasis on fostering critical thinking skills to understand its potential and limitations and to make ethical use of these technologies
2. Enhancing critical thinking and creativity by allowing students to receive feedback on their assignments and question their beliefs

# Helping lecturers

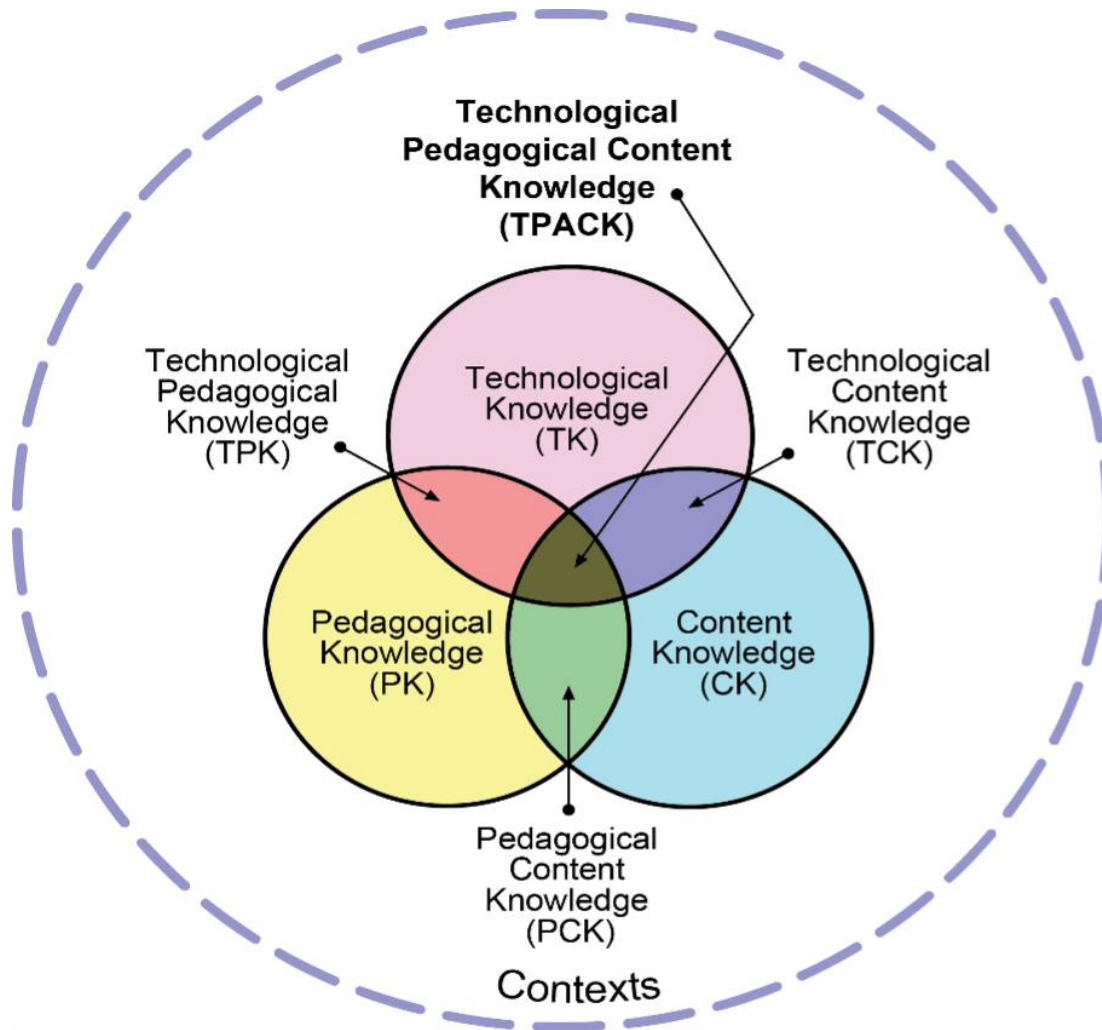


1. Generation of extensive sets of educational content
2. Generating personalized problems, guided by students' needs
3. Improving teachers' productivity by reducing the time spent answering the same student questions, grading written assignments, etc., allowing them to focus on higher-level tasks, such as providing feedback and support to students
4. Supporting automated assessment and other innovations in evaluation

# Generative AI open challenges in education

## 1. Teacher training in generative AI competencies

# Generative AI open challenges in education



The TPACK model (Koehler and Mishra, 2009). Reproduced by permission of the publisher, © 2012 by tpack.org

# Generative AI open challenges in education

1. Teacher training in generative AI competencies
- 2. Reviewing, updating, and innovating curriculum content and teaching methods that may have become outdated, along with addressing the resistance to change**



# Problems on the education system

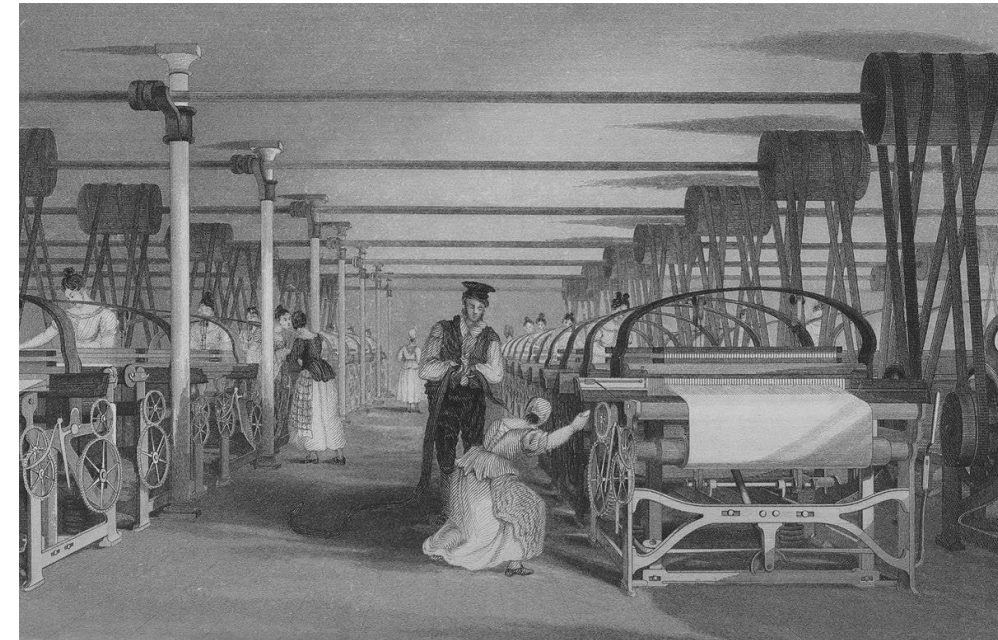
Our current education system was developed during second industry revolution

- Mass production and standardization
- Too rigid, few electives...

Also, curriculum is mainly for a 2.5 industry in a 4.0 industry world

- Keeping the curriculum up to date is costly

**This can be the time for a deep change!**



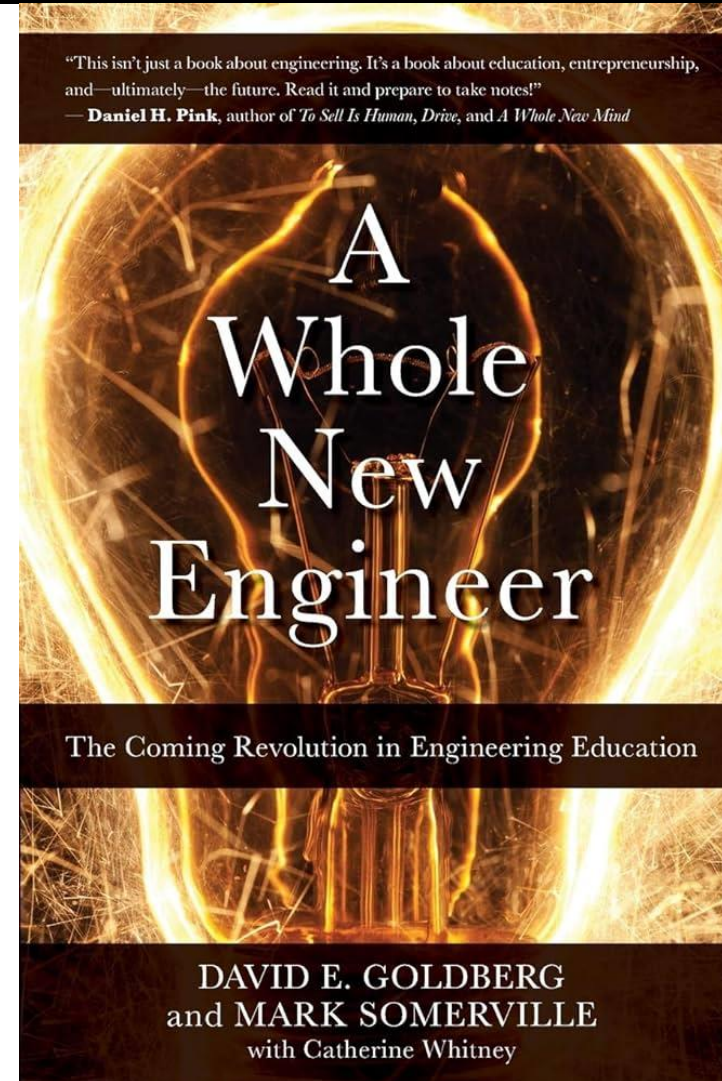
# Problems on the education system



Olin College  
of Engineering



**PURDUE**  
POLYTECHNIC



Goldberg and Somerville (2014)

Edu**STEAM**

# Generative AI open challenges in education

1. Teacher training in generative AI competencies
2. Reviewing, updating, and innovating curriculum content and teaching methods that may have become outdated, along with addressing the resistance to change
3. **Exploration of alternatives and/or complementarities in assessment methods, utilizing open ended evaluations to encourage originality and creativity, and emphasizing the importance of the learning process rather than solely focusing on the final product**

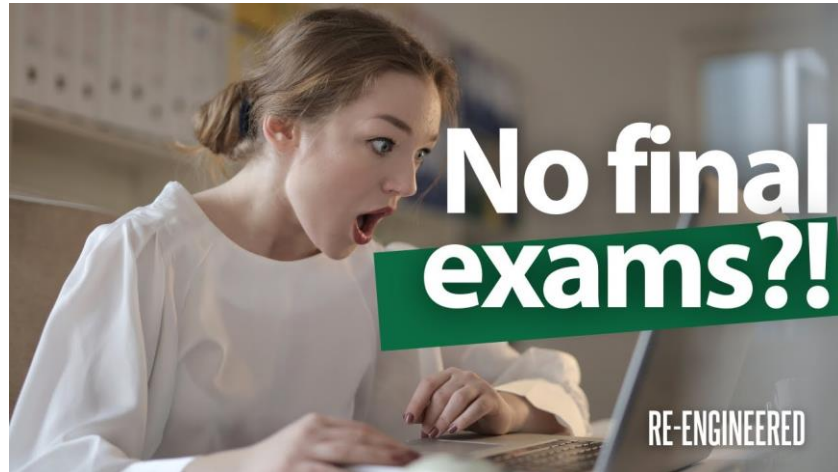
# Problems on classes and assessment

Our current education system was developed during second industry revolution (time of standardization)

- We rely on lectures, despite we know is not the most effective way of learning
- We assign problems easy to grade
- We evaluate individuals (but our students will work in groups)
- Our system is based in “credit-hours” (i.e. subjects)

AI can help in many ways (Swiecki et al 2022)

# Generative AI open challenges in education



Promoting:

- Deep learning
- Authentic learning
- Integrative learning
- Lasting learning



**PURDUE**  
POLYTECHNIC



Edu**STEAM**

# Generative AI open challenges in education

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3. Exploration of alternatives and/or complementarities in assessment methods, utilizing open ended evaluations to encourage originality and creativity, and emphasizing the importance of the learning process rather than solely focusing on the final product
4. **Development of ethical codes and the establishment of general guidelines regarding generative AI, ensuring responsible and ethical practices in its implementation**

# Cheating and beyond..

## Addressing academic cheating

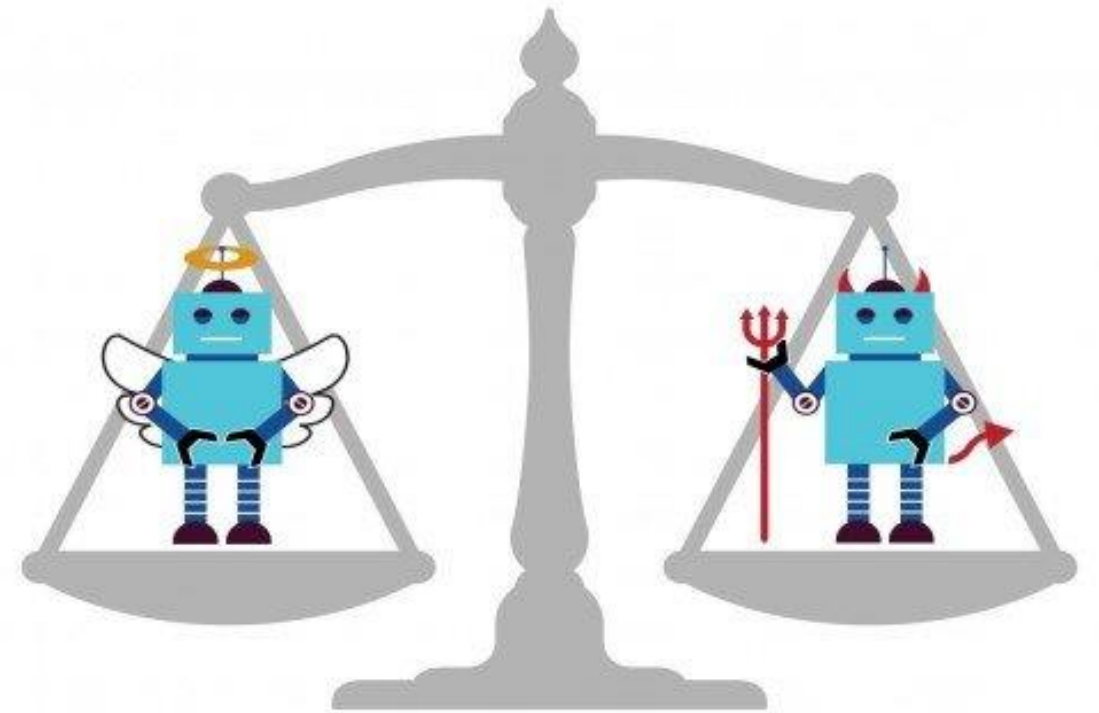
1. Back to Stone Age
  - Offline tests & emphasis on oral presentations
2. Legitimate methods
  - Anti-plagiarism tools
  - Manual checks
  - Creative assignment redesign
3. Social engineering
  - Focus on ethics



# Conclusions

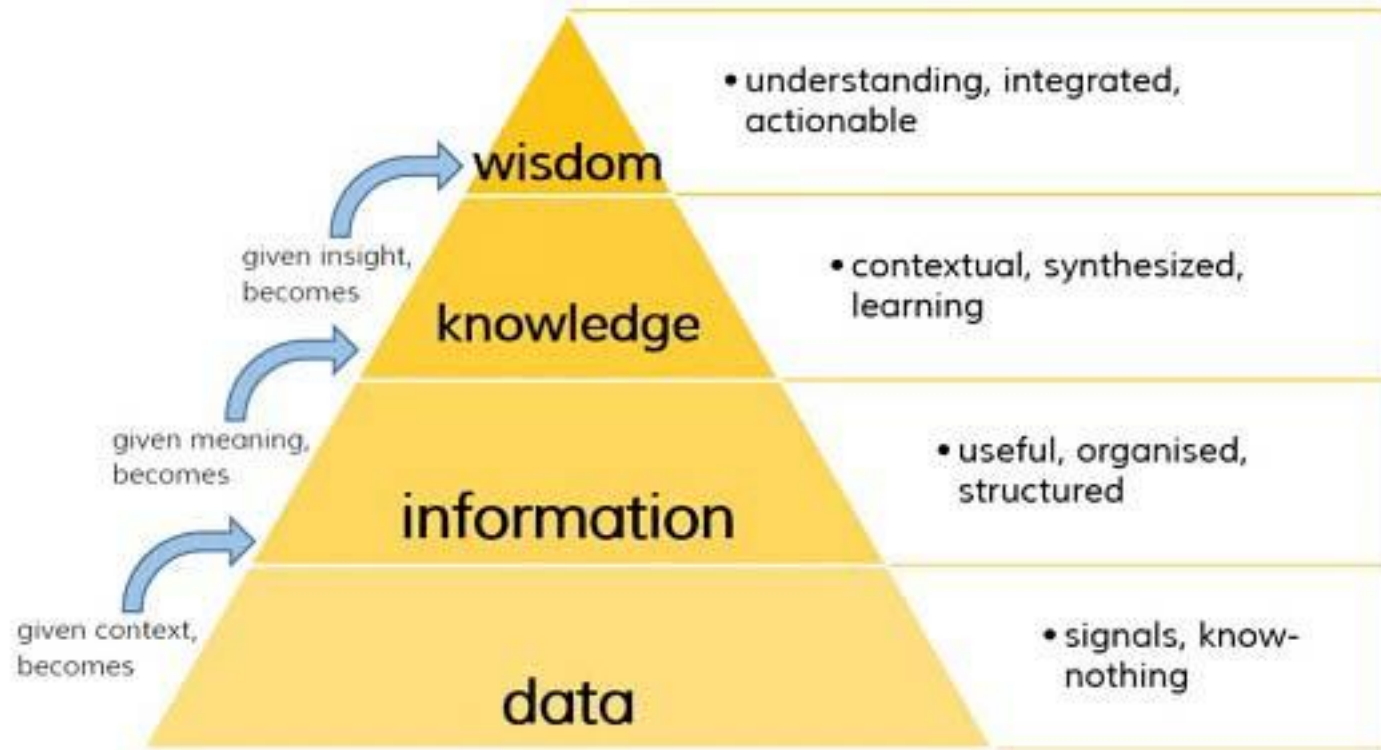
It is time to:

- Take benefit from what AI can offer
- Train teachers and students in their proper and ethical use
- Revise curriculum
- Rethink assessment





# An opportunity



# An opportunity

*Where is the wisdom we have lost in knowledge?  
Where is the knowledge we have lost in information?*



T.S. Eliot – The Rock

# References

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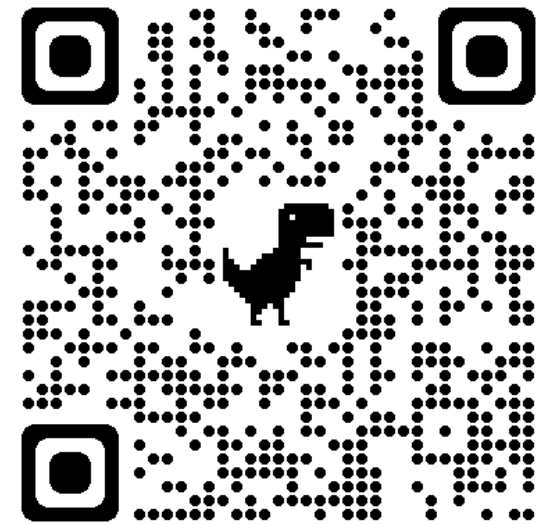
## Many thanks to

- Marc Alier
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- Faraón Llorens
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## Recommended reading

García Peñalvo, F. J., Llorens-Largo, F., & Vidal, J.(2024). The new reality of education in the face of advances in generative artificial intelligence. RIED-Revista Iberoamericana de Educación a Distancia, 27(1).

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## Some possible discussion points

- What needs do students (and academics) in informatics studies have regarding the disruptive emergence of AI?
- Do we properly address the needs of ethics and computational thinking in informatics studies?
- Perhaps the time has come to make a profound change in the curriculum. How can we approach it? What resistance will there be?
- What teaching and assessment methods will we need? Or were they already needed and AI has just shown us?

